SATELLITE T.V.R.O. DIGEST

November 1981

$3.00

ANNOUNCEMENT: SATELLITE TELEVISION INDUSTRY ASSOCIATION WILL HOLD ITS NEXT SHOW IN LAS VEGAS, NEVADA JANUARY 7-10, 1982 CONCURRENT TO THE CONSUMER ELECTRONICS SHOW — COMPLETE INFO NEXT MONTH.

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Intro

Welcome to the first issue of what I hope will be the best and most useful magazine that you, as satellite tvro enthusiasts, will have around to enjoy and reference.

This first issue probably will be a little on the rough side. As engineers and designers, most of us were not trained in the fine art of magazine production. Hopefully you won't laugh to hard at the mistakes and will find that as time goes on things will get better. The data I'm sure will offset the non-slickness, (see, I can coin those funny words too) of the magazine.

The talent pool being used to provide this magazine ranges from Vice-presidents to hobby enthusiasts. It covers the full range of expertise in the fields of video modulation, communications, research and design. We will be pooling this expertise to provide construction projects, theory and the latest news for you.

Unlike the expensive and, (in most cases) outdated "MANUALS" available currently, in the $35 to $75 range, this magazine will be providing current, state of the art, pertinent theoretical information. We will be providing dealer type hints and tips. In the future we will propose a theoretical system and develop the system.

There will be sections for:

1) The "basic" homebuilder, to build or add to his receiving system.

2) The "advanced" hobbiest, to expand his current understanding.

3) A Computer corner will publish helpful engineering and business programs.

4) A Video corner by an engineer who teaches video.

5) Dealer hints and tips from active installing dealers.

6) Product reviews done impartially and with the right equipment.

7) Programming and hardware news.

8) Letters and answers to the questions asked in them.

9) A trade or sale section for test gear, parts and receiving systems.

And Editorials on the industry, shows and systems, by yours truly.

In the magazine we will actually be designing a third generation receiving system. Starting with the theory and working right thru to the finished receiving system. This system will employ its' own LNA and block converter. We will also develop a system for multi-user environments, hotels, motels, trailer parks and small subdivisions. Which will have the option of low power transmission in place of the cabling. We will also be developing the test equipment, Spectrum Analizers, Signal Generators and other helpful gear to use on your test benches. One of these will be a low cost color bar generator at 4 Ghz. And all as inexpensivly as possible.

We will study antenna mounts of different types and how to build them. Multi satellite will be with us in another year.

Generally we are going to keep you as close to the cutting edge of new technology as possible. Note the excusion into Digital.

Here's What's scheduled for some of the upcoming months:

MONTH	GENERAL	HOBBY	ADVANCED
November	History of the Private TVRO's	An inexpensive 70 MHZ IF Strip	LNA Biasing Techniques
December	MTV(what it is and how it works)	Audio Demodulators	LNA Downconverter Combination
January	The double conversion RCVR	PLL, divide by 2 demodulators	4 GASFET LNA
February	STIA Show variable and stereo	special audio mixer amplifier	Double conversion
March	Single conversion receivers	Discriminators linear and digital	single conversion image reject
April	Block conversion receivers	Remodulators	Block conversion front end
May	Small cable and hotel/motel	Power Supplies	Block conversion converters
June	Retransmission Systems	Metering	UHF remodulators
July	Digital TV Systems I	Demodulator Update	A/D conversion
August	Digital TV Systems II	Wireless Remote Control	D/A conversion

And any other submitted operational information.

New GASFETs Coming From NEC

NEC is about to release two new GasFETs of interest.

First is the 700, a despected 137, 1.0 noise max., for $55. The other, the 720, a despected version of the "workhorse" 218 for $15. The typical LNA could then be one 218 at $45 and three 720 at $15 for a total of $90, $225, using all 218's. This move makes the low cost LNA one step closer.

The GasFETs are available from:

California Eastern Laboratories
3005 Democracy Way
Santa Clara, CA 95050

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Contact:
SATELLITE TVRO DIGEST
319-627-4983

Basic Product

THE 70 MHZ IF STRIP

The heart of most current TVRO receivers is the band shaping and amplification circuit. This circuit is usually centered around 70 mhz and this is considered the Intermediate Frequency, Hence the name.

Over the years, starting with John Yurek in 1972 and Steve Birkill thru Paul Shuch and Taylor Howard in about 1979 and into modern designs by Bruce Simpson and Myself, this vital part has evolved and matured to what is about industry standard today.

John Yurek is a very talented hobbiest however poorly published, except in amateur radio circles. Steve Birkill is also talented and well published. Most of the early development was attributable to Steve's published data and ideas. To this day he continues to be active in the field.

Paul Shuch, in 1978, formed a company named "MICROCOMM" to sell his kits, modules, and construction manual for a TVRO receiver named "RX-4200". This was the first hard set of plans available to the hobbiest. This was later to be ICM's best receiver the ICM-4200. More on this receiver in other months.

Taylor Howard, in 1979, got hooked up with Bob Cooper and they jointly produced the Howard receiver manual. Although there were some differences between the two these were virtually the same receivers. This manual, because of it's publicity, soon became the most popular and is still being used to date. It is not what is considered good RF design but it does work. Modified to somewhat better, depending on which, design this circuit is still used in several receivers. Mr. Cooper got Tay Howard and Bob Coleman, the junk dealer, together and this design is still being marketed today as the "HOWARD/COLEMAN" receiver. From these and Paul Shuch's plans most of us started and rapidly evolved.

It is with this IF strip that we will therefore start.

Figure 1 is the block diagram of the "Howard" IF strip. The numbers across the top are the theoretical gain/loss characteristics by stage in db. The numbers across the bottom are the cumulative gain characteristics. Good receiver design calls for balanced stage gain. In this case the amplification before the filter is +15 db, loss across the filter is -5 db and post filter amplification is +45 db, hardly balanced. This imbalance causes the noise from the filter to be amplified far more than the signal to the filter.

Figure 2 shows the schematic diagram of this IF strip. The coils are hand wound and the circuit calls for expensive modular amps. Because of the limited LC ratios available the circuit is not very frequency agile. (IE) The center frequency can be moved only a small percentage.

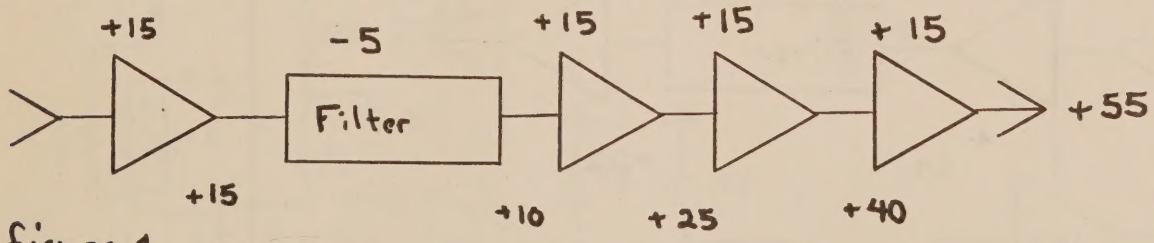

figure 1

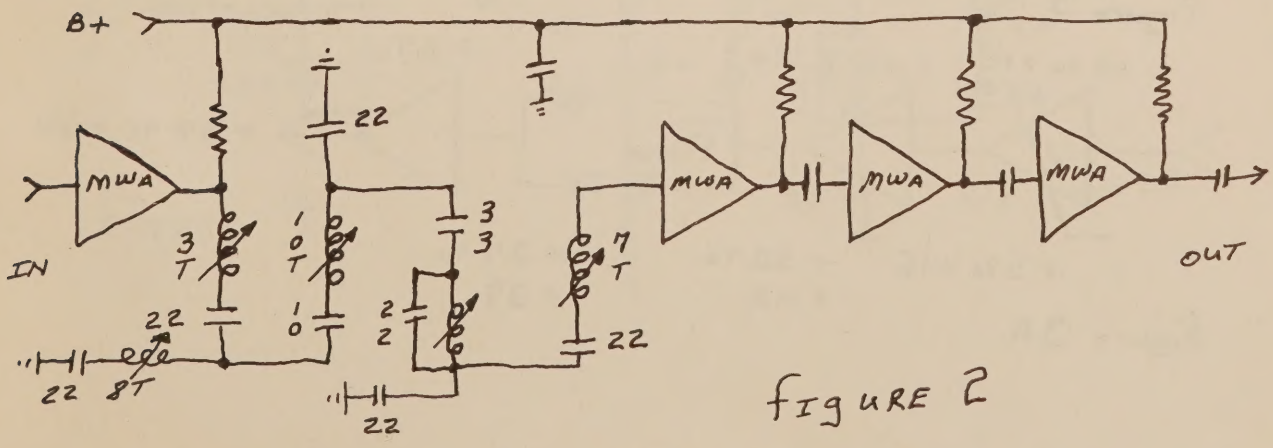

figure 2

Figure 3 shows the first IF that I used in my early radios. Again the top numbers are the theoretical gain/loss and the bottom numbers are the net gain figures, in db. The primary difference is the gains are almost balanced. The end result shows a lower net gain by 6 db. However, there is also a lower noise contribution. This leads to better pictures. To add flexibility this circuit was modified to figure 3a. This added a variable gain stage in front of the first IF amplifier, of fig. 3. Note that using this setup the net gain is now variable from 54 db, 1 db less than the Howard, to + 64 db, 9 db more than the Howard. Also the gain imbalance is now prior to the filter, to keep the out of band noise down, and allow for gain variations in these or prior stages.

Figure 4 shows the schematic of the IF circuit from figure 3a. The coils are still hand wound and suffer the same bandwidth restrictions as the Howard circuit. However these coils are IF cans, shielded, rather than the unshielded type of the Howard, and therefore have less tendency to crosstalk and cause oscillation. The amplifiers are NEC hybrids and again are not inexpensive. This was a vast improvement from the Howard.

With the advent of single conversion it became advantagous to have a more agile IF strip to walk to one side of an image, no the imageless mixer is not without images no matter what they say.

In order to get more agility a higher LC, inductance to capacitance, ratio was needed. This led me, and other engineers, to work with band pass filter CAD, computer aided design, programs to generate filters with 20 mhz pass bands at different center frequencys. The program was then told to generate a constant inductance and provide extrapolated results based on variable capacitance and plot the theoretical pass curves for each. A part of this system will be found under the COMPUTER CORNER. These curves were then studied to provide the best compromise for agility.

Figure 5 shows the block diagram of one of the final products. Note the theoretical values are not much different than those shown in figure 3a. Net

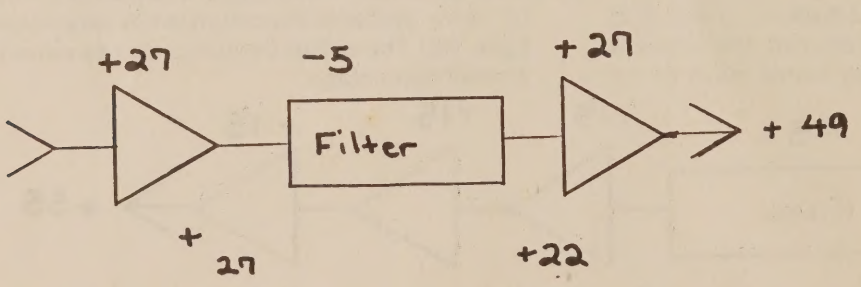

figure 3

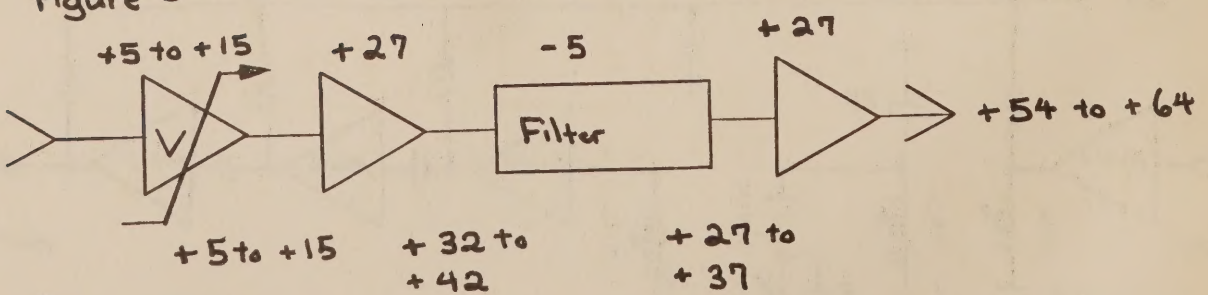

figure 3A

gain is up and the filter can now be set to any center frequency from 60 to 90 mhz.

You will note also that I use the term theoretical. In practice the circuits do not meet these specs. This is one of the first things you learn about when using CAD programs to help you design. These are really what is known as best case numbers.

Figure 6 shows the schematic diagram of this IF filter. Note all variable elements are now capacitors and all inductors are now fixed. This means you don't have to wind and maybe rewind the inductor. You plug in the parts and tune. It's a lot cleaner. Also all gain elements are transistors with ft of 300 mhz or better, no expensive hybrids. I use a standard switching transistor, 2N3904 or 2N2222, however any good high frequency transistor will work. The transistors are not without their drawbacks. Like all transistors the like to amplify low frequency better than high frequency. To correct this before the filter LC bandpass filters are used interstage and after the filter LC high pass filters are used interstage. You may not need the high pass filters if your using a PLL demod, but it won't hurt. In my case, my digital discriminator is linear over a frequency range of 10 to 150 mhz and will react to any out of band signal of sufficient strength so I get as much of it out as possible. The high pass filters are set to approx. 50 mhz. I also changed the gain element to a transistor, for simplicity.

While this is not THE problem with the Howard/Coleman receiver it will help.

Figure 7 is the artwork for the bottom and figure 8 is the top of a PC board to implement this IF strip. The finished size of this board is 1.3 inches by 3.5 inches.

Figure 9 is a parts placement overlay, top, for this PC board. All parts are listed in the parts list with the manufacturer and number of the parts that may be hard to find. Note that a PC board and a complete parts kit are available.

Construction is straight forward, put the right parts in the right places and solder. Be careful not to create solder bridges.

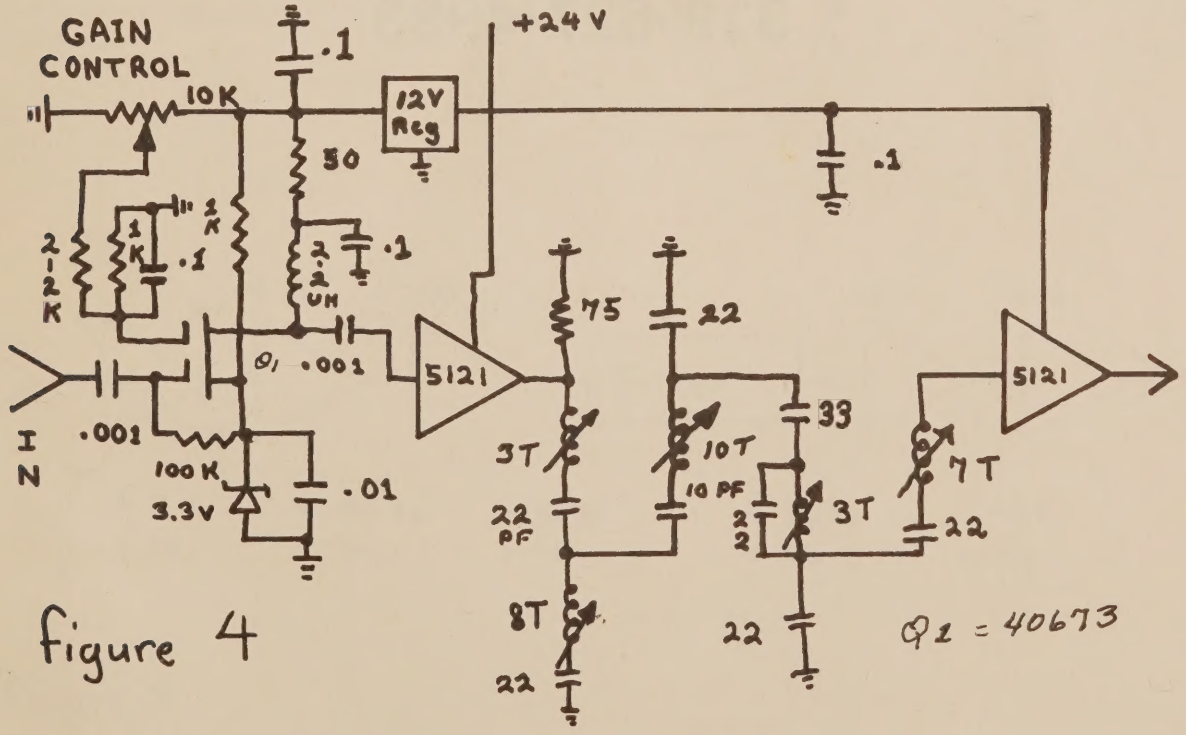

Figure 4

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After construction check the +12 volt input with a ohmmeter to be sure its not shorted. Apply +12 volts and ground. Check transistor voltages, base should run about .6 volts and collectors should run about 6 volts. Set the VC4 capacitor 180 degrees from where it was from the vendor. Apply 70 mhz signal from satellite receiver's conversion. Hook ouput to demodulator input. Set variable gain to center. You should obtain some sort of picture. Set VC1, center freq., for best point. Set VC2 and then VC3, low freq. skirt, for best point. Set VC5, wideband pass, for best picture. Set VC4 (high freq. skirt) for best picture. Move gain control for best picture. Do this several times. If you are among the lucky few who have a spectrum analyzer tie the analyzer to the output, with the demod, and tune for best passband. In any case check the final result live. Sweeping is very nice but it cannot generate the same dynamics as a live signal. If that's all you can do then do it. Later, after you're running do the final tweek with a live signal and monitor the real picture. Remember that this filter will not correct for the problems of the 564. We'll cover ways to do that in January.

I hope this will help some of you and get others of you started.

Parts list 70 Mhz IF filter/amp.

Q1 — 5	2N3904 or equiv. transistors	
R1 — 5	100 K 1/4 watt 5% resistor	
R6 — 10	560 ohm 1/4 watt 5% resistor	
R11	100 ohm 1/4 watt 5% resistor	
VR1	1 K multi-turn trimmer pot	
C1 — 6	.1 mf	
C7 — 8	47 mf or larger	
C9	470 pf ceramic	
C10 — 13	15 pf	
C14 — 16	33 pf	
C17	22 pf	
VC1 — 3	1 — 10 pf variable 3 mm	
VC1 — 3	5 — 35 pf variable 3 mm	
L1 — 2	470 uh choke	Dale IM—2 or IR—2
L3 — 4	.33 uh choke	Dale IM—2 or IR—2
L5 — 8	.15 uh choke	Dale IM—2 or IR—2
L9	.56 uh choke	Dale IM—2 or IR—2
L10	.68 uh choke	Dale IM—2 or IR—2
L11	.47 uh choke	Dale IM—2 or IR—2

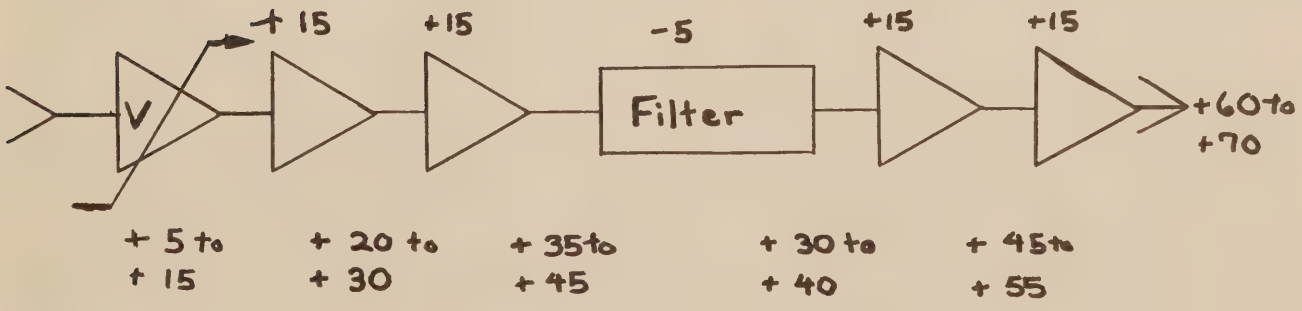
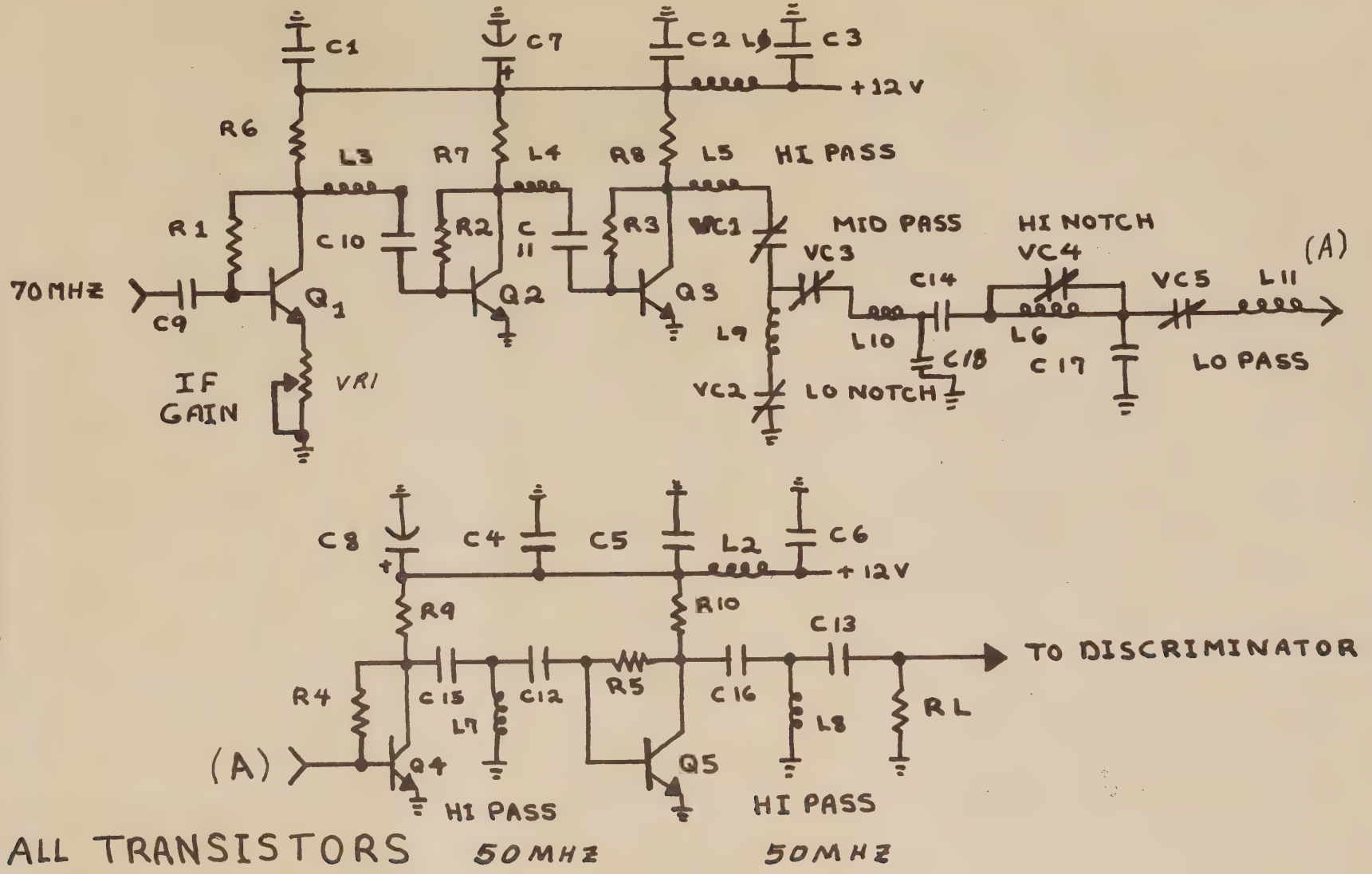


figure 5



ALL TRANSISTORS 2N3904

50 MHz

50 MHz

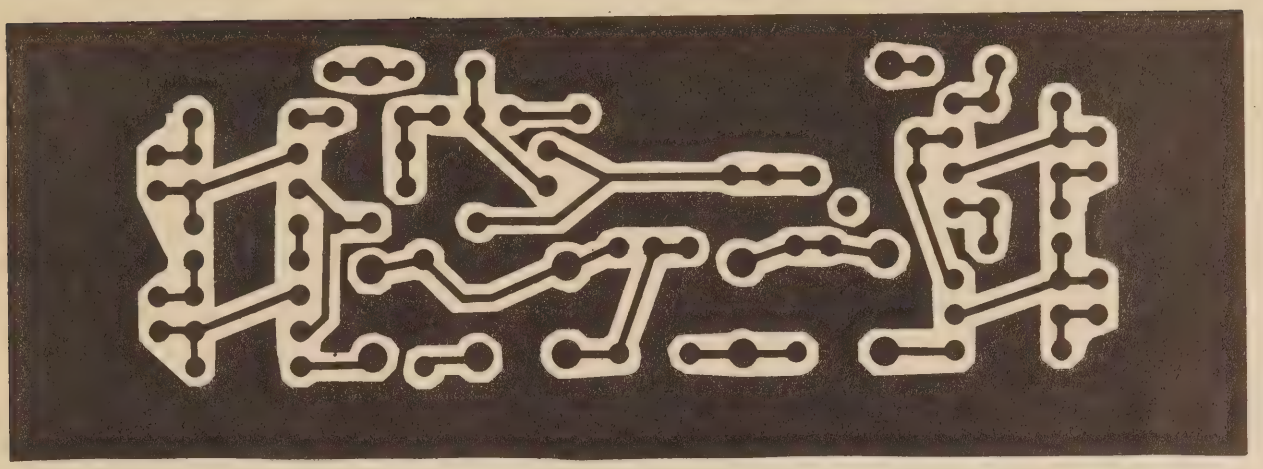


FIGURE 7 - BOTTOM

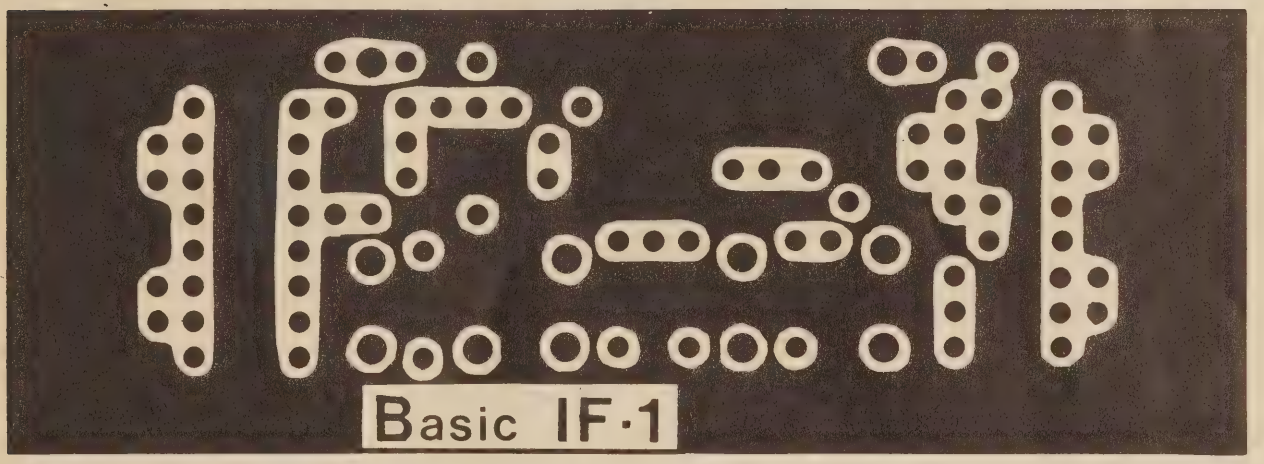
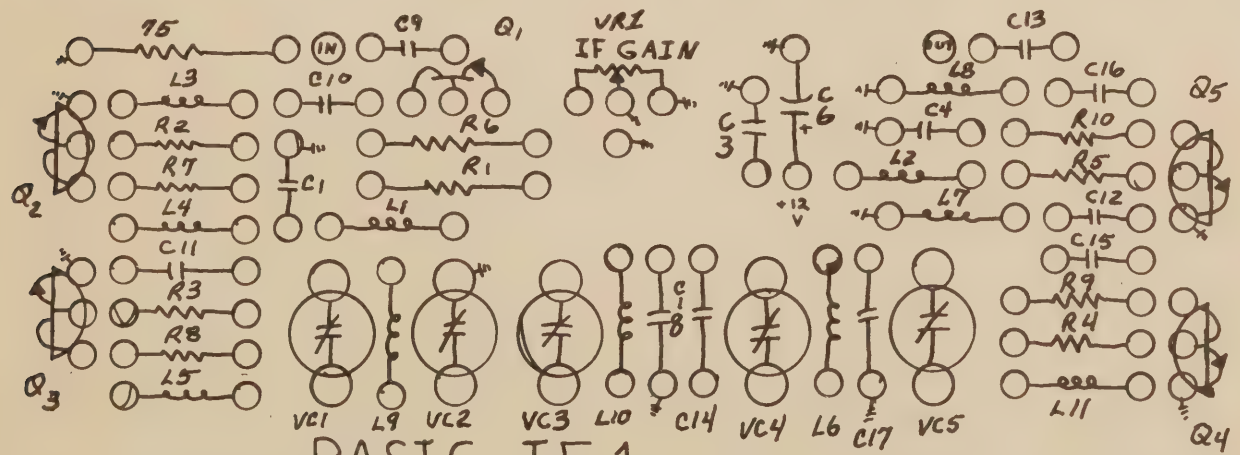


FIGURE 8 TOP



BASIC IF 1

FIGURE 9

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TVRO Receiver History

The private satellite TeleVision Receive Only (TVRO) system started with John Yurek in 1972 and then Steve Birkill in 1978 on to Paul Shuch, Andy Hatfield and Taylor Howard in about 1979 and into modern designs by Bruce Simpson, Clyde Washburn and Myself. The vital receiving system has evolved and matured to what we have today and is evolving into tomorrow.

John Yurek is a very talented hobbiest however poorly published, except in amatuer radio circles.

Steve Birkill is also talented and well published. Most of the early development was attributable to Steve's published data and ideas. To this day he continues to be active in the field.

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Andy Hatfield, an engineer (Shuch and Howard are college instructors) in the communications field, was versed in the technology of the commercial receiver manufacturers and decided that personal equipment should perform far better than the PLL would do. He put his design talents together and started producing what was the benchmark for all good receivers to hit, the AVCOM.

Bruce Simpson, also an engineer, started his own company, Simmcom labs, and started selling kits based on a discriminator similar to the one used by Scientific Atlanta. His real forte was microstrip and LNA design. Bruce has published some very good data on this subject.

Better known than most is Clyde Washburn. Clyde is a talented design engineer in the specific area of PLL's. The kind used by multi-channel frequency agile receiving systems. In 1980 Clyde prepared a paper explaining a new system based on ECL parts as the PLL. Bob Cooper rushed Clyde into producing a manual. This manual was then changed monthly for several months and Clyde, who got rushed for kits, spent many hours on the phone trying to help those who were trying to build it. To satisfy the kit and finished unit orders he sold the system to Ramsey at Sat-tec. Ramsey also failed to deliver on time, I know of people today still waiting for the rest of their kits, and failed to get the finished product out the door. This was a great embarassment for Clyde. Clyde yanked Ramsey's license and sold the idea to some investors and is now doing well.

I come also from an engineering background. Before RF devices I designed computers, software and operating systems for private and government entities. In 1969 I developed what became the 100 watt CB mobile linear amplified, I can see all my ham friends cringing, and produced them until I sold the company in 1975. My next project was a 1.6 to 29.9999 mhz multi-mode (cw, usb, 1sb, am and fsk) 284,000 channel paramilitary manpack. This Transceiver was multi-synthesis and controlled by a CMOS microprocessor. I then came back to Iowa to redesign one of my brothers products, before he went broke. I had been used to 24 hour a day TV and in Iowa everything was gone at 2 am. I aquired the needed reference material, and a "Satellite Pioneer Status", and set to work. Now I hope to share all the good stuff with you and dump on all the phoney baloney.

Alas I'm ahead of myself aren't I? Let us Quote from REVELATIONS according to BC:

BC 1. 1.

"THE SEED for the first private, backyard "home satellite terminal" was probably planted in the mind of pioneer home terminal owner Bob Cooper in the summer of 1975. While attending a cable television trade show, the cable industry arranged to show off a coast-to-coast satellite linkup. This was the first private use of satellite television, and it required the joint efforts of perhaps a dozen corporations and more than $500,000 in satellite receiving equipment to pull off the one hour telecast. The cable industry was agog. Bob Cooper decided he wanted one of these in his backyard. But not at $500,000 each.

In the years that followed, Cooper set out to find why a parabolic antenna and two pieces of electronics should cost "so much". First he discovered that the Federal Communications Commission had a "rule" on their books requiring all satellite terminals to be licensed by their agency. The same rule also required that all satellite receiving antennas be "...9 meters in size, or larger..."; to be licensed. Cooper applied for a license of his own, under experimental authority, and purposefully asked that he be allowed to "experiment" with smaller antennas; down to 3 meters in size. The FCC granted the license request. At the same time Cooper prepared a formal application to the FCC seeking that they do way with (1) "...9 meter size limit", and (2) subsequently, "...terminal licensing". Both petitions would ultimately be approved by the FCC but only after Cooper testified before Congressional committees pointing out that FCC rules were slowing down the progress of new technology. Finally, in 1978, Coop cracked the "price barrier" by finding and encouraging two fellow home builders (Taylor Howard and Robert Coleman) to "share their secrets".

Taylor Howard was a Stanford University Professor at the time. He would later become the first President of Space, the new industry's trade association. Bob Coleman was a "ham experimenter" in South Carolina. He would become a major designer of satellite receiver units for the "home market". Each would, in 1979, "headline" Coop's first "Satellite Private Terminal Seminar", the world's first technical conference dedicated to the "sharing of technology."

BC 1. 2.

"A SHOW

The Third SPTS was held in San Jose, California in the summer of 1980. One of the highlights of this show was the first public display of satellite receivers priced under $1,000, and, the first public reception of the Russian "Molniya" satellite. As luck would have it, the evening we tuned in "Molniya", this "internal Russian television service" was carrying a special report on American spy activities in Russia! Hundreds saw it, poolside, at the San Jose SPTS.

By the fall of 1980, Houston, Texas was the gathering spot for the first "Satellite Business Opportunity Conference" (SBOC). The emphasis here was on getting started in the business of selling and installing home terminals. This was the biggest (crowd) to attend an event to that time, and hundreds of new dealers cut their teeth on this meeting's training sessions. The big news at that event was the introduction of reasonably priced motor driven (i.e. automatic) "tracking" antenna systems.

The next event was held in Washington, D.C. in April of 1981. By this point in the industry's history, federal legislation was threatening and the industry's young trade association (SPACE) was doing battle with groups who wanted to slow down the growth of home satellite terminals. Washington was the logical choice for such a meeting and an FCC Commissioner, Ralph Nader and numerous Congressmen attended and addressed the gathering. Home satellite terminals had grown up!

The most recent event was held in mid-August in Omaha, Nebraska. Reacting to the onrush of new companies and new products being offered, this SPTS staged an "antenna shootout", where antenna manufacturers offered their antennas for critical test and measurement. The results of these tests, published in the recent September (1981) issue of Coop's Satellite Digest, clearly showed that there can be wide differences in antenna performance!"

End of REVELATIONS BY BC for now.

Anyone who has been around this industry very long knows that this is pure BS. The shows cost $150 dollars to get into, $750 to have a booth for and the seminars are given by well meaning, if mislead, UNPAID persons who are taped by Mr. Cooper who in turn sells the tape and pockets ALL the money. I wonder what the house subcommittee would think of that.

Although I have presented the Revelations somewhat jokingly Mr. Cooper did have his place in the history of our business. He was a prime publicist and entreprenuer. IE his shows and EARLY magazines were helpful publicity and he made so much money he bought an island and built a TV station on it, as we all PAINFULLY have seen. He was also kicked out of the cable organizaion he helped found and asked to leave CATJ magazine for internal (?) reasons. The line he puts out is strictly his own. For instance they did have an antenna shoot out, of sorts, at Omaha. However the results were not "clearly" anything in the magazine.

You will also note that HE did it all, without a good nodding electronic background. Even when John Yurek was 3 years B.C. (BEFORE COOPER). This and lots of other misinformation sent many hobbiests into problems that simple RF design techniques would have handled simply had the original data been correct. This is one Book of Revelations that do not speak of GOD.

I seem to have left out one designer who was

responsible for the good, cheap and easy antenna. Hayden McCullough took some work started, or continueing from the TORUS project, by Oliver Swan and perfected it into the current and common spherical.

But back to receivers.

The earliest of these receivers were single-channel. You wanted HBO? You bought a receiver for their channel. WTCG (as it was then), another receiver. CBM? Another. It soon became obvious that the single-channel receiver was doomed. Even to keep a spare for use on more than one feed meant a kit of crystals, bandpass filters, and a load of adjustments to change from one channel to another.

With frequency agility, the traditional receivers had to become complicated. Where originally a crystal oscillator with multipliers, or a present phase-locked source had been used for the local oscillator, a synthesizer was now required. Where an RF stage or mixer could have been optimized in the region of one channel, it now had to deliver adequate performance across the whole 3.7 to 4.2 GHz band. And, most significantly, single conversion wasn't quite so easy if the whole band had to be covered.

In the fixed-tuned receiver, it did not matter that an IF as low as the standard 70 MHz was chosen. This was a convenient IF for filtering and demodulation, so the "image" response, 70 MHz on the "wrong" side of the local oscillator, was removed by a bandpass channel filter before the mixer. Now to tune that oscillator through the band meant that the filter had also to be tuned exactly in step, to keep each wanted channel in its bandpass window. And since a filter of adequate performance needed at least four tuned elements, these too had all to track through the band in perfect step. This is not to say that it can't be done, one prominent receiver manufacturer chose just that tracking filter technique, but such a filter is difficult and expensive to design and align.

Most manufacturers went to double (or dual) conversion.

So the designs diversified. Slightly. The double conversions chose a first IF in the range 700 to 1200 MHz, for good enough reasons. They made their first conversion oscillator the tunable one, typically with a synthesizer circuit locked to a low frequency crystal, channel selection being by thumbwheel switches on the front panel. The second conversion (mixing) oscillator was fixed, except where AFC was applied to it, and the final IF is the good old familiar 70 MHz, so the "back end" of the receiver need not be any different than before. The 70 MHz signal was filtered (to define channel noise bandwidth) amplified, limited and demodulated with a frequency discriminator circuit.

Not all followed the same path. With the high cost of terminal figure of merit (B/T) in terms of dollars per dB, there was benefit in improving threshold performance. If you could produce a receiver which gave no more sparkles at an 8 dB C/N ratio than your competitor's did at 11 dB C/N, your customer could get by with a 4.5 meter dish instead of a 6 meter. Some incorporated FM feedback demodulators, FM tracking filters or phase locked loop demodulators, to give threshold extension. At least one design skipped the second conversion completely and performed phase locked demodulation at the first intermediate frequency, in the UHF range.

In the mid-seventies, John Yurek of Penn. was working on his third version of a low cost receiver, Peter Warren of Texas was developing a low-cost receiver design for evangelical TV. Steve Richey of Oklahoma was investigating simplified receiver designs for economy production. Steve Birkill was working on the "block-downconvert, tune, PLL, demod" approach.

And then in early 1979, Standford professor Taylor Howard began to circulate the details of his innovative low cost receiving system, a system which he documented in detail to enable others to duplicate. Howard's R.F. section was similar in outline to Shuch's suggestions, being double-conversion with a first IF in the region of 1200 MHz. His video demodulator used the phase lock loop IC, the NE564, and capable of wide band performance. Howard chose the Avantek hybrid packaged voltage tuned oscillators for both conversions.

So here was a receiver design which not only broke away from the conventions of synthesizer channelizing and discriminator demodulation, but came complete with manufacturing instructions. It was not long before a series of "Howard" type receivers came onto the market under several manufacturers' names.

These receivers broke new ground in the TVRO components price structure. For the first time, 4 GHz to baseband cost less than $2000. But being designed and built "down to a price", the engineering quality of some of these sets left much to be desired. They did not travel well, light-weight construction in "consumer appeal" plastic cases did not hold up. There must be many in use that have never met their specified performance, due to critical adjustment points having become misaligned in transit or never properly set.

Fortunately, most used the packaged oscillator and mixer modules, so the problems were not at the microwave end, though some incorporated their own "on board" mixers.

They tended to be awkward to tune, with a single turn pot calibrated 1 to 24, for channel selection, and quite rudimentary, if even operational, AFC.

The NE564 loop itself, while being adequate for experimental use, was at the limit of its range when tracking full-deviation, high color saturation video. As the loop lost lock on color peaks, large amplitude noise transients were produced which upset the receiver's clamp and produced buzz on the demodulated audio. The high quality reputation of satellite TV was threatened by its exposure to a whole new audience through the medium of these "cheapo" sets, often working at or below threshold. (In all fairness, though, in the below threshold condition these receivers, by virtue of their phase locked demodulators, gave better results than their professional counterparts. It was with good signals that their short-comings were most apparent.)

The difference between one manufacturer and another was measured by the frills and trimmings fitted to their receivers. Switchable or tunable audio subcarriers, programmable channel selection, automatic polarization selection, LNA powering, stereo decoders, lights, meters, remote controls. All these were simple to add to the basic design, and these "knobs, screws, toggles, bells and whistles" could be promoted in the competitive market-place.

But eventually new light began to dawn. People stopped shouting about what wonderful "new technology" their machines represented, and began to look again at receiver design. Yes, Howard's receiver was a good design, but there was no need to be bound by it. There were other first IFs than 1100 or 1200 MHz, other second IFs than 70 MHz, other oscillators than W-J or Avantek, other mixers than Vari-L. And there were other demodulators than NE564. Some manufacturers took the commercial demodulators and brought them up to current technology and then found ways to improve and economize, without or with very little, degredation in quality.

The 564 was still the simpler way, however. SO some technology was "borrowed" from the Micro Wave Associates receiver, involving a binary divider. The 70 MHz second If was amplified, limited and divided down to 35 MHz, where (yes) the Ne564 did the demodulation. Although percentage deviation was unchanged, the 564 was now comfortably within its design frequency range and as a result coped happily with peaks of saturated color at high deviation. But some of the loop's threshold advantage was lost in the limiting and division and the 564s, unless hand selected, were not totally without their saturation problems, but much better.

An alternative avoidance of "564 streaking" came with the rediscovery of the discriminator. Several of the second generation receivers have adopted limiters and discriminator demodulators operating at 70 MHz. When correctly aligned these give excellent video and audio quality, though with conventional FM thresholds in the 10 to 11 dB region. Likewise the digital and delay-line demodulators, with their near perfect linearity.

The single-conversion approach has not been neglected in the search for innovative and economical hardware. Unfortunately perhaps, tired old 70 MHz has been the IF of some of the single-conversion designs. Without image-rejection, a single-conversion radio with 70 MHz IF has a second, spurious response with spectrum inversion, displaced 140 MHz from that desired. By accident of channel spacing (RCA system) this second channel, if inband, is always on a transponder of the opposite polarization to the desired one, and midway between transponders of the same polarization.

Image noise can be a problem even with a high first IF but with single conversion to 70 MHz with a conventional mixer, its penalty is severe. Consider the receiving system with no signals, you've steered the antenna west of F1 so you're seeing just noise; sky noise, antenna noise and (mainly) LNA noise. Now that noise arrives at your receiver's input jack over a wide range of frequencies. Your LNA will not cut off sharply outside the band. But will continue to give gain (and generate noise) outside of band. The low end roll-off will be particularly gradual. Transistors naturally want provide higher gain at lower frequencies. So with a low IF, noise from the band (LO+IF) and noise from the band (LO-IF) will appear equally strongly in the IF. Put a signal into the wanted channel, at 10 dB C/N, and your IF sees that, plus the noise in the image channel. So C/N at IF is degraded to 7 dB, and your picture dives into the sparklies, making the single-conversion receiver look rather sick as an economy measure.

But there are ways of making single conversion to a low IF give acceptable results. The best approach is the image-rejection mixer, not a new concept but only recently applied to consumer microwave. A 3 dB hybrid splits the signal input into two paths with a 90 degree phase difference, each feeding a separate mixer. The local oscillator signal is split by an inphase power divider to drive the two mixers. From here the classical approach is for the mixers' IF outputs be recombined by a 3 dB hybrid at intermediate frequency. This hybrid has two output ports, one of which feeds the IF amplifier and demodulator, and the other is terminated. The

output terminated is reflective of the sideband. The side can be either above or below the oscillator frequency, while the unwanted one (by definition the image) is attenuated to an extent dependent on the degree of amplitude and phase balance of the two mixer chains. This image rejection of 10 or 15 dB can be achieved quite readily, and 20 dB or more with painstaking design. The new approach returns to basic RF engineering for its simplicity. The two signals are separately amplified and then combined resistivly. One side across an inductor and the other across a capacitor. By making the capacitor variable the delay across the capacitor in relation to the other signal, across the inductor, can be varied. This has the effect of modifying the circuit timing and allows the balancing out of the image. Don't let anyone kid you it is NEVER IMAGELESS no matter what the ads say. However 15 to 25 dB is easily obtainable. Considering noise alone, 10 dB rejection will result in .4 dB degradation of C/N and 20 dB will degrade C/N by only .04 dB, an insignificant amount. In using the image-rejection mixer you must be aware that there are additional losses in the RF splitter to degrade noise figure compared to a single mixer.

These factors must all be understood when installing an economy-priced system, or the unexplained anomalies will continue. There are enough people who regard the technology as "magic", without encouraging those who regard making it work as a "mystic" art.

Engineering has already started and a new generation of receivers will soon appear, engineered for quality as well as price.

The phase lock loop may be resurected at first in discrete component form, to demodulate directly from a high IF, with full threshold extension.

70 MHz single conversion will give way and block downconversion at the antenna will take over, an approach I started on two years ago, with the UHF carrying all 12 channels available to be amplified as two blocks, one for each polarization, split into branched feeds resembling small cable systems, where individuals will tap off, tune and demodulate the channel(s) of their choice without tying the entire terminal to one channel.

With discrete tunable UHF phase-lock loops, the component count and cost will be below that of today's double-conversion sets, without the limitations of the present IC PLLs. New high IF discriminators will simplify the demodulation.

The logical way for signal-processing technology to go includes a UHF remodulator, clamped AFC, and an AGC system capable of optimizing gain dependent on input C/N ratio.

This will all be possible with integrated Gallium Arsenide technology, and will remove all filtering requirements except that to define pre-mixer bandwidth. Video processing will also become more sophisticated, and will include impulse-suppression using the delay-line techniques borrowed from VTR drop-out compensators, enabling effective thresholds to be lowered to 6 dB.

The digital world may also start to unload some of its tricks. A/D and D/A will become semi normal. Image enhancement and processing via microcomputer will start to produce excitingly enhanced viewing.

There are several new technologies that could reduce the size and cost.

It is likely that some of the technology will impact the 4 GHz TVRO world only after having been developed for use in 12 GHz DBS.

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Hobby Type Biasing Figure 1

The 1N4148's are polarity protection diodes to save the expensive GaAs-FETs.

The circuit shown utilizes a pair of 10K pots to set the GASFETs gate voltage. Utilize the following procedure to set for best performance:

1) Before applying drain voltage, set the 10K pots for -.5 volts on gates.

2) Monitor voltage drop across resistor R1 at the first GASFET

3) Turn on the 4.5 volt supply (drain voltage).

4) Adjust the 10K pot for .33 volts drop across R1.

5) Do same at R2 thru Rx.

The current to each device is approx. 10 mA.

Power Supply (Hobby)

C1 - C4	4.7 pf chip capacitor
C5 - C8	1000 pf chip capacitor
D1, D2	1N4148 diode
VR1, VR2	10K multiturn trim pots
R1, R2	33 ohm, ¼ watt, 5% resistor
R3, R4	10K ohm, ¼ watt 5% resistor

Commercial OP Amp Control Figure 2

Commercial design parameters are more exact than the Hobby approach. We require a unipolar power supply with a positive ground, a wide temperature range stability, and individual current control for stability.

U2 is a brand new (in January 1980) part manufactured by Intersil and it sells for around $3. This is a single CMOS 8 pin DIP which generates -5 volts from +5 volt supplies. It requires only a pair of additional parts (capacitors) to do its job and will perform over a -20 degrees C to +70 degree C temperature range. You will note that I add a third part, a 1N4149 (or any silicon diode). This device operates only when the power supply is turned off as the 7660 (CMOS) relaxes quite slowly. This means that the high frequency oscillation slows down and at a certain frequency just before it quits a

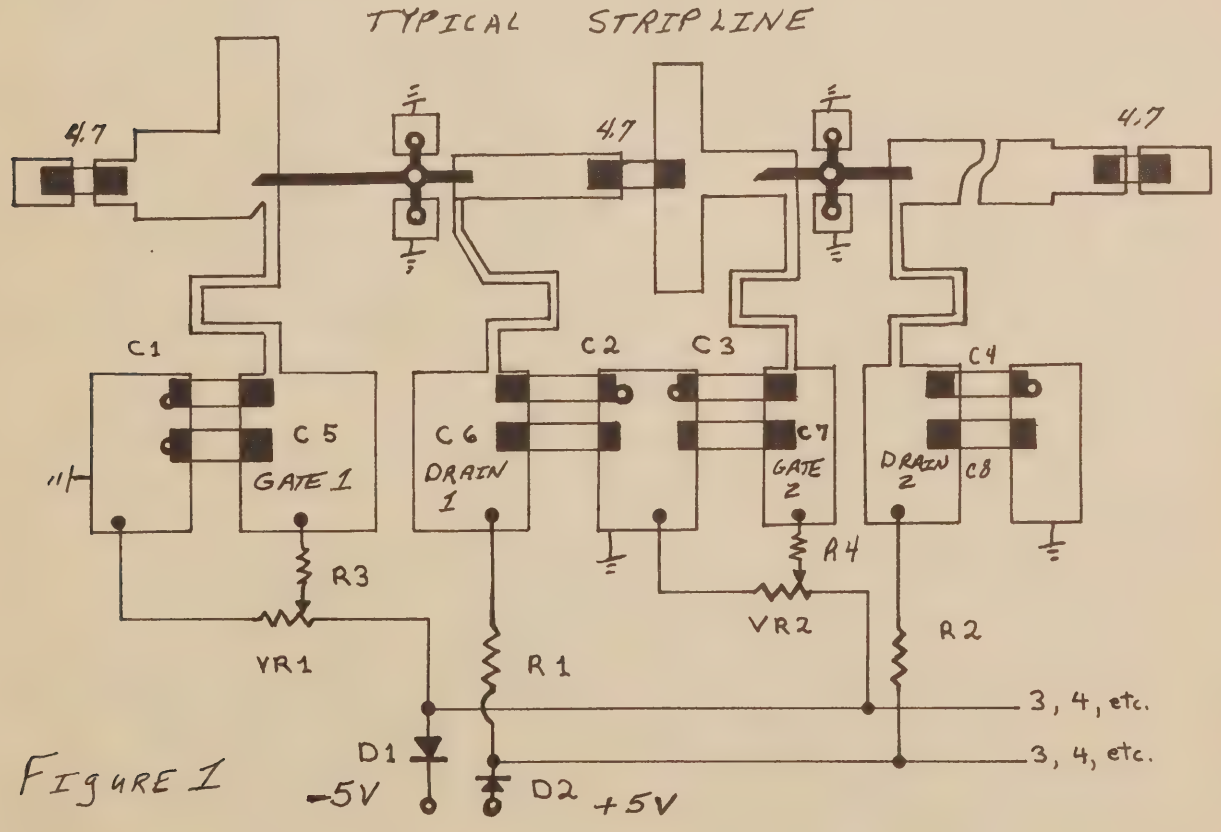


FIGURE 1

square wave appears at the output pin. The diode does not allow the square wave to get across and raise any difficulties with the OpAmp.

This circuit uses a pair of 741 type Op Amps as current comparators. The current is set by pots A1 and A2. Once set, the op amp will maintain the transistor, at the current established, over wide tempeature excursions. The importance of this may not be readily apparent. The GASFETs get their best noise figure at a low current; 3 to 5 mA being typical. However they get their best voltage gain at a higher current; 10mA being typical. It is very important in designing an LNA system, wherein noise figure is established by the first or lead transistor, that you set the operating parameters for that (first) stage for lowest noise temperature or noise contribution.

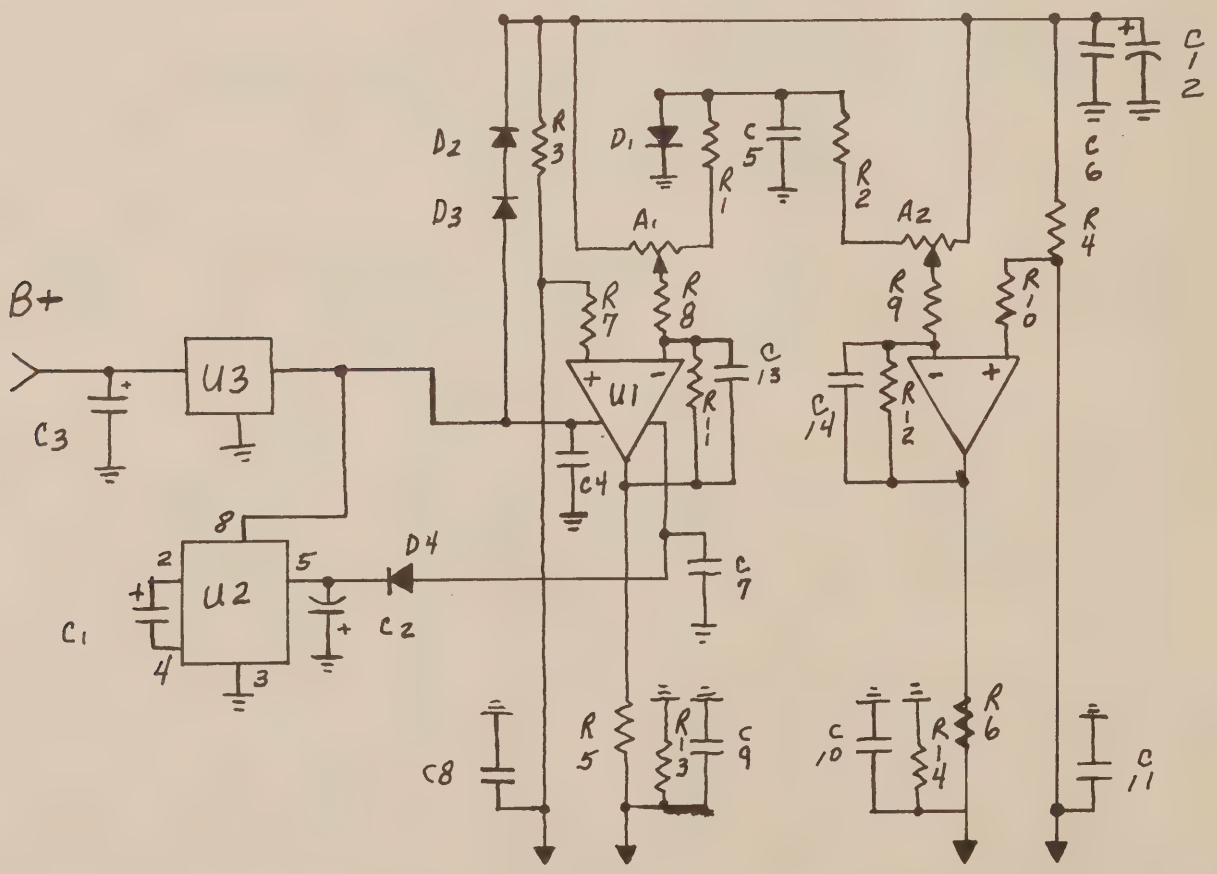
Additionally, if a GaAs-FET is going to be unstable, it will try to oscillate and when it does this it will draw additional current. So if we can control the current we can also keep the stage from oscillation.

Parts List Power Supply (OP AMP)

U1	1458 OpAmp	Motorola
U2	ICL 7660-5V Generator	Intersil
U3	7805 5V Regulator	
A1, A2	500r 20T Trim Pot	
D1 - 4	IN4148 or Equiv Silicon Diode	
C1, 2, 3	1 MF 15V Tant Cap	
C4 - 11	.1 MF 15V Cap	
C12	22 to 100MF 15V Cap	
C13, 14	.001 MF Cap	
R1, R2	4.7K ¼W 5% Resistor	
R3 - 6	10r ¼W 5% Resistor	
R7 - 10	10K ¼W 5% Resistor	
R11, R12	1 Meg ¼W 5% Resistor	
R13, R14	3.3K ¼W 5% Resistor	

Set Up Procedures . . .

Once you have the circuit built-up the set procedure for the biasing system prior to hooking up the LNA board is as follows:



1) Turn on V-in (something less than + 30 volts DC)
2) Set the 500 ohm pots (A1 and A2) to their mid position. - .5 volts to gate.
3) Turn off V-in.
4) Bleed power supply to ground and check for zero volts. Now connect the gate voltage points to the LNA.
5) Connect a milliamp meter between the drain 1 output and the drain 1 input on the LNA
6) Jumper drain 2 to the LNA temporarily
7) Apply V-in.
8) Set A1 for the proper operating current. 3 to 5 ma.
9) Remove the power and bleed the drain voltage to ground.
10) Remove the milliamp meter and solder drain 1 output to the LNA board.
11) Place the milliamp meter in the drain 2 line
12) Repeat steps 7, 8, 9 using A2 and 10 ma.
15) Remove milliamp meter and resolder the drain output to the LNA board.

Now find a housing and install the LNA and biasing boards inside. And check it once again. If you happen to have test gear to allow you to check noise figure set A1 for best noise figure and A2 for best gain. If you, like most of us, do not have such fancy test equipment install the LNA system in line with an operating TVRO receiver and set A1 and A2 for best looking picture. Now seal it up and leave it alone.

The typical settings for best performance for a two-stage system is 3 mA on the first NE 218 (optimum noise figure performance) and 10 mA on the second (third etc) NE 218 (maximum available gain or MAG).

Negative Voltage Generators

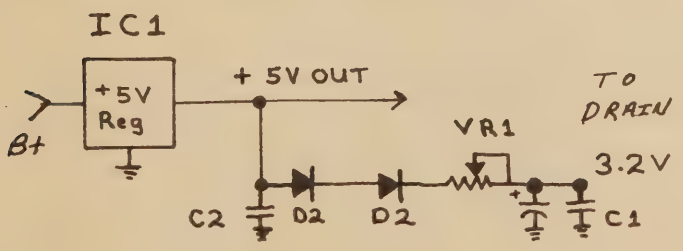


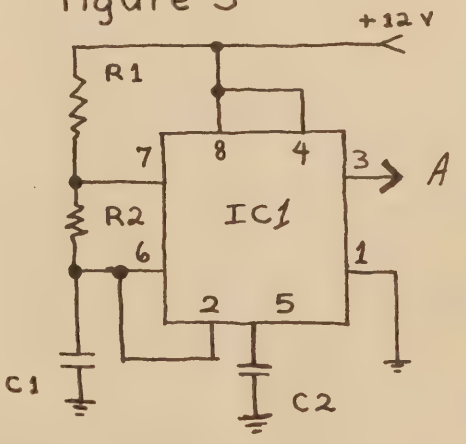
Figure 3 shows the oscillator set up to use a 555 timer IC as a 10KHz square wave oscillator. This circuit requires a regulated +12V DC to operate properly. And the 555 timer can cause some spikes when turned on and turned off. It will work but is not the best. The spike can get past the filtering circuitry and the zener and blow the GasFET. Careful layout and parts selection will somewhat eliminate the problem. But.

Figure 4 shows an oscillator/driver set up using a CMOS inverter package. This unit can be built from almost any CMOS inverter package. However better current, power, drive is produced by the 4049 and 74C04 type hex inverter. The VCC to this circuit can be varied between +5 and +15 volts without much variation in operating characteristics. The particular advantages of this circuit are its soft turn on and off. The disadvantage is the limited amount of current available. This gives VCC flexibility while maintaining enough current for biasing, not much reserve.

Figure 5 is a TTL version of figure 4. The VCC must be maintained at +5V. This circuit has the advantage of good power, current, drive and it will not produce more than -5 volts under load. The turn on/off is a little harsher than the CMOS version but still better than the 555. The 7404 may also be easier to obtain than the 4049 or 74C04 units.

While I prefer the intersil 7660, it is very hard to find in the hobby supply markets. The 555 is quite plentiful and so are the digital integrated circuits. Given my choice I would choose the CMOS circuit for this particular application.

figure 3



PARTS LIST POWER SUPPLY (fig. 7)

IC1	7805 5 volt voltage regulator
D1, D2	IN4148 or equiv diode
VR1	100r single turn trim pot
C1	1000 MF 6V tant cap
C2, C3	.1 25V capacitor

PARTS LIST 555 TIMER (fig. 3)

IC1	555 Timer IC
R1	1K ohm ¼ watt 5% resistor
R2	4.7K ohm ¼ watt 5% resistor
C1, C2	.01 25V capacitors

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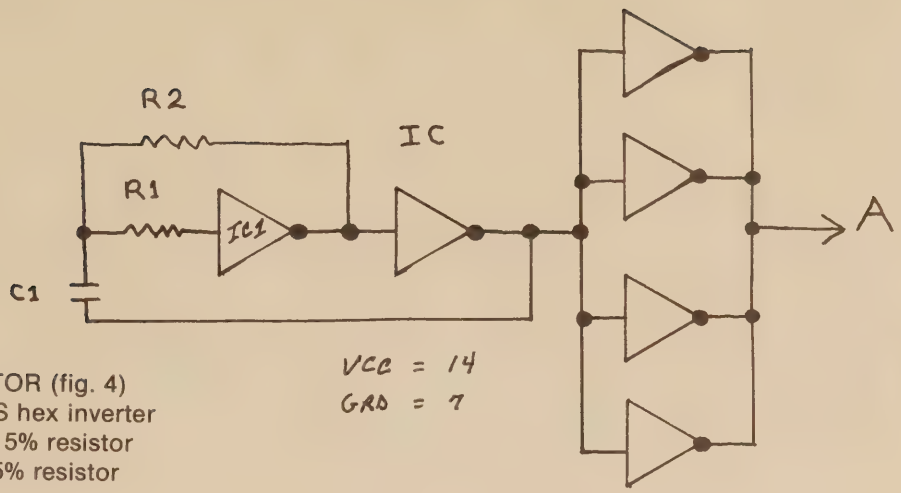
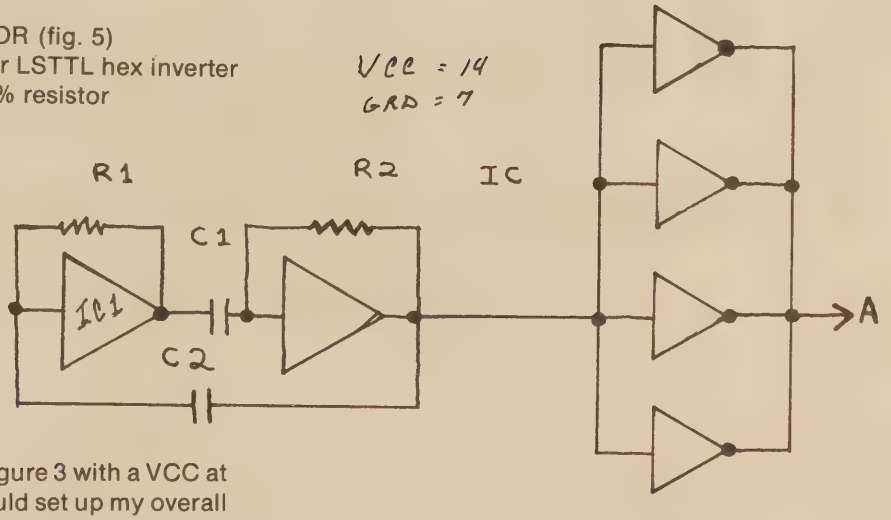


PARTS LIST CMOS OSCILLATOR (fig. 4)

IC1	4049, 74C04 CMOS hex inverter
R1	1 meg ohm ¼ watt 5% resistor
R2	100K ohm ¼ watt 5% resistor
C1	.001 25V capacitor

PARTS LIST TTL OSCILLATOR (fig. 5)

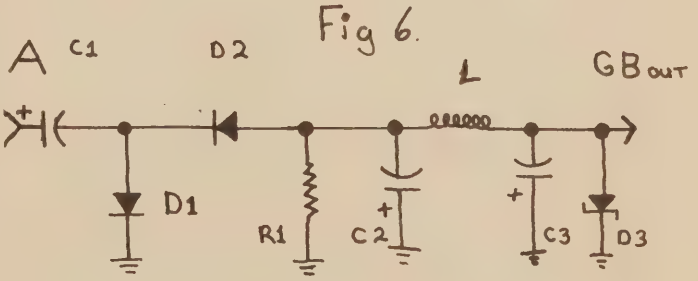
IC1	7404, 7414 TTL or LSTTL hex inverter
R1, R2	1K ohm ¼ watt 5% resistor
C1, C2	.01 25V capacitor



I would set up the circuit of figure 3 with a VCC at +5V, no reason to over kill. I would set up my overall power supply as in figure 7. Setting VR for output of 3.2V. This allows VCC input up to 36 volts without putting undue stress on the power supply in the LNA. In case you want to use the VCC line to vary the low frequency. (which we will cover in later editions).

Figure 6 shows the common coupling DC and filtering circuitry. C1 is the coupling capacitor to pass the AC. D1, D2 are the DC rectifiers. R1, C2, C3 and L1 are the DC filtering network. L1 can be anything from 120 thru 470 UH chokes. D3 is a 5.1V zener and is used for protection against over voltage at GB out.

Fig 6.



Summary

Now a low cost GaAs—FET amplifer with good performance specifications is within reach of the home builder.

Next month the three stage LNA with block conversion.

PARTS LIST DC FILTERING (fig. 6)

D1, D2	IN4148 or equiv diode
D3	4.7, 5.1 or 5.6V zener diode
C1	10 MF 15V tant cap
C2, C3	100 MF 15V tant cap
R1	10K ohm ¼ watt 5% resistor
L1	100 to 470 uh choke

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Dear Sir,

Just received my 1st copy of RCVR newsletter and I was very impressed. The good news about an affordable magazine containing just the information I have been looking for, made me want to send in my subscription immediately, so here it is. I don't want to miss an issue. I have been delaying my purchase of earth station equipment until someone came along to settle the disputes over technology, price & performance. It looks like Sat TVRO Tech may be the answer. Good luck.

Sincerely,
Blaine B. Campbell

ED.

I was amazed at how many letters came in like this. I would liked to have published some others, from people getting the expensive brand, but most of these were too violent and I did promise George I wouldn't use the publisher of the "EXPENSIVE" brands name in vain, at least not in print.

Dear Mr. Rohner,

Inclosed is a money order for a very exciting sounding magazine.

I understand you will have a letter column for those of us having problems, questions and or contributions. Well here's my problem.

I put together a Howard receiver using Coleman boards. I have a lot of birdies in the downconverter. They're strong enough to wipe out an incoming channel. By raising or lowering the tuning voltage to the 970 MHz oscilator (Avantek 8090) the birdie will move over and let the channel come through but is annoying to have to do so.

I would also like to add a 70 MHz divider circuit using the MC10131 chips. Where can I obtain a pin layout for it?

For my contribution; most cable companies have short surplus, under 100 ft pieces of 3/4" hardline co-ax, that will pass 4GHz with little loss. With their regular fittings and BNC connectors a very reasonable 4 GHz fieldline can be obtained.

Thank you for giving us some well guarded information not readily available to the tinkerer.

Yours truly,
Don Hixson

ED:

The Howard/Coleman Kit is without a doubt one of the worst designs currently available to the hobbiest. It is also the most popular. Several problems exist in the basic design. First, the 900 MHz gain is non-existant. The PC board layouts are worse than most home builders do on their own. The 12 volt regulator should replace the 15 volt regulator (the whole thing runs better on 12 volts anyway). The 70 MHz IF strip is not agile (see 70MHIF this issue).

In my experience with this system, is that the 970MHz osc. seemed to operate better when set to the low side, 830 MHz. Teh best you can do is move it a little bit and then re-tune the 900 MHz IF filter until it finally settles into the best for that one unit.

The PLL and Divide by 2 will be covered in detail in the January issue. Pin outs can be obtained by calling Motorola and asking for their ECL design and Product Handbooks, 10K ECL Logic.

Thanks for the tip.

Dear Sir,

First I would like to express my gratitude on getting a newsletter with such a wealth of information. I would like to be placed on the mailing list.

Second, I am interested in purchasing a used PLL or Disc Receiver which is a trade for new types. I do not want one which requires electronic repair, unless that is the only type available. If repairs are required, will I be informed on what to repair when I get the unit? Are repairs usually as easy as replacing an IC or transistor? Please answer these questions and if a non-repair used model is in stock, please Hold it. I will definitely want a non-repair used model.

Do these older models have the front end located at the antenna? Do they have inverted switches? How can I get a manual on building receivers from you?

I'll be subscribing to Sat TVRO Digest soon. It's good to know there is a reasonable priced alternative to Coop's over priced, one sided view of the CATV industry.

Thank you,
C. Westbrook

ED.

First; that was the last newsletter. Second, the "HOBBY" units are available "whenever I got one", and generally no real time is spent on them other than making sure they produce a picture. Full schematics are included. The "hobby" units may be of my or other manufacture. They are meant to give the home builder a leg up toward a working station. They do not carry any warrantee. Some are split, some are double conversion and some are non-split. This magazine will (one month at a time) provide you with all you would need to build your own system.

Dear John,

I'm glad to see progress in the TVRO systems area. A lot of credit is due to you it seems. I've been fascinated reading your newsletters since last year. I'm sorry my recommendations to our school district to buy your receiver was cut due to budget last year.

Your strugles seem to be the benefit of everyone else. I'm impressed and have been thinking of quitting my teaching job soon and opening a TVRO dealer/maintenance business. My qualifications are good. I've been managing a non-profit religious video service. I've got a physics B.S. degree and a first class FCC license. I've even got two summers of successful door to door sales experience. This year we just purchased a farm in Arcata, California with some great barns and outbuildings. Just watching the recipients of your newslette grow and the price of the "Basic" go down is encouraging.

What I would like to know from you is an honest opinion (which I think you are quite capable of giving) of whether it would be a good idea for me to quit my job and jump into a slightly economically depressed area where our farm is located and start up a TVRO business. Is it practical for one person like me to think, with hard work, that the prospect if good of keeping the bills paid? Has anyone started one of your dealerships in northern California yet? I know as busy as you are, it'll be something if you even read this letter, but I appreciate any response you can give.

Hope to order the "Basic" in December, 1981 or January, 1982 and look forward to setting it up on our farm when we get there in May, 1982.

Best wishes to you, and success.
Sincerely,
Lou Brandon

ED.

I don't feel that with the way the current economy is now is a good time to leave a "known" for an "unknown". But I'm older now. When I was younger I might have (I formed the FIRST company to manufacture and sell CB 100 watt solid state linears in 1969). I think I would do it in my spare time and over the summer, first. I think the prospects for success are good. I do not think they are "overnight". You will note that lots of new manufacturers keep starting and ending, and their area is the entire country. Admitted some are or have put out bad product, but some of the current manufacturers are doing that. My advice is get your feet slowly wet, make sure the water is to your liking and be prepared to fix TV sets if you need to for survival. The "BASIC" is being sold everywhere. No matter whose RCVR you get I welcome you to the group.

Mr. Rohner,

I received your RCVR Newsletter and I want to thank you very much.

I am interested in your manual on "How to build a Modern Satellite Receiver."

What I wold like to know is when is it available? What is the price? And how do I order? Also, if I purchased your Basic for ($750) seven hundred fifty dollars, what more would I need to complete a working TVRO system? I wonder if you could answer a question for me? Are the front end and down converter the same stage? Or are they two different stages?

If I purchased the following kits (Receiver & Front End and LNA, 4GasFet) would that complete the whole system other than the feedhorn and antenna?

I would appreciate it very much if you could answer these questions for me. Thank you very much.

Sincerely,
Robert Bunce

ED:

The "MANUAL" has become a magazine, this one. See editorial for full review. If you purchase ANY receiver you still must have the five basic components: antenna, feed horn, LNA, receiver and remodulator (unless it's built into the receiver). You will also require assorted coax and a rotor of some kind. Some manufacturers call the down-converter the "front end" some call it "imageless down

converter" (even though there is no such thing as IMAGELESS direct conversion). They are all the same, the piece that goes at the antenna and converts to some frequency (generally 70 mhz) so that inexpensive cable can be run to the house. Unless your an engineer or have lots of time do not build an LNA kit. Buy it. Get pictures. Then if you want build the LNA. Why? If you build the antenna, feed horn and receiver you are starting with four variables, those you built plus aiming. Add coax and LNA and your up to six. I did this once and spent several months "discovering" that my parabolic dish had a different focal point than I thought and that I was aimed between two satellites. I now have the test equipment to help but I wouldn't go thru that again.

Dear Mr. Rohner,

I have read several issues of your satellite newsletter with great interst. In your last issue (August/September) you mentioned the oncoing of digital TV. This is an area that we have done a great deal with and are currently monitoring with a high level of interest.

For your information, we manufacture the world's only monolithic analog to digital converter which is fast enough to sample NTSC and/or PAL composite TV signals and convert to an 8 bit digital format. This integrated circuit has become very popular with manufacturers of studio television equipment where the digital format has several advantages over the analog.

I've enclosed data sheets on the TRW 9,8,6, and 4 bit high speed data converters for your information. Also enclosed is our RF Linear Hybrid Amplifier designer's guide. I'd appreciate hearing from you if you feel that any of these products have possible application in some of the areas you are currently studying.

If you travel plans should take you to Los Angeles at anytime in the future, I would be pleased to have you visit with us and see some of the technology we possess actually in practice.

Sincerely,
Robert Walker
TRW/Electronic Components Group

ED:

I would like to thank Mr. Walker for his input. The data sheets were enclosed and are being held so that we can run them with the articles on Digital TV and Digital types of Enhancement. I hope that we will see much input from all parts of the industry to help us learn and build.

You would be very surprised what can be done to a Video Frame when using a Micro Computer as an element in the A/D and D/A Conversion. We will present more on this.

Mr. Rohner

From the first I have certainly welcomed your newsletter. I have watched the private TVRO situation developing for some four years. I would like to be the first to congratulate you in your attempt to clear the smoke from this unholy mess. Transmission and reception of microwave energy, and at much higher frequencys than satellite TV uses isn't exactly new. I performed maintenance on a 9.2 GHz system that was developed in the early fortys, so the only big differences I have observed are component peformance and size reduction. As for keeping something secret, (I know neither your or Mr. Cooper) he is playing a fool's game. I carried a secret clearance from the U.S. government for some twenty years, so I feel I know a little whereof I speak regarding secrecy. Anyone familiar with the government printing office and how it works can attest to that. As for trade shows, magazines, and the like if they do not become cost effective they are surely last. The TVRO field at this point is at the same stage CB radio was in the early sixties. For those of you who are attempting to establish order, I say hurry. A TVRO system is nothing more than a passive receiver, they have already multiplied beyond government control and detection. God forbid if it ends up at the same point CB radio is today.

You have my permission to use this letter in whole or in part.

John W. Edwards

ED:

One of the driving points behind this magazine is exactly this sentiment. I also spent some time with the US Government and I was involved as a manufacture in CB. I watched that industry finally grow, because of the freedom allowed it. Our industry is young and formulative now. We need the passing of the best, most accurate information available. We don't need to have expensive, non-productive Data sources.

One of my dealers found a vey interesting point while displaying at a country fair. Lots of the market has heard of the systems, but: none of them believed it would work for them until after they saw it work. I think this is a very pertinent lesson. Also should the government decide to regulate us, there's power in numbers.

Editorial

AND IN THIS SPACE IS THAT CRAZY ENGINEER.

One thing I wish to warn you of now is the one thing any of you who have talked to me, live or otherwise, know. DON'T expect my comments here to be political. I deal with facts, in this column I say what I know, not what I'm supposed to. Each month you will have your choice of reading or not reading this column. Don't read it if you don't want to know what's going on and how I feel about things. SO be ye fair warned.

Catastrafy, that can't be spelled right, always strikes the first born, or so it seems. This is true of this one too. Glenn, the video specialist had his first article lost and the backup copy won't get here in time so the video corner will start next month.

We thought we had backed up the antenna article by going to two suppliers, one eight weeks and one six weeks ago. Alas today the magazine is being transmitted and the one ordered six weeks ago shows up. Don't know about the other one. So next month we do an article on the antenna.

I have a terrific article nearly done on MTV and how it works. But I'm out of time to get it checked and get the artwork done, so next month you'll get the MTV article.

Several other interesting articles have arrived but no time to get them entered and get anywhere close to the closing date. You will note the magazine really does come the month its published. We set a closing date of the first of each month to have all articles, to be published, on the computer and checked out. We then dial up the typesetter, or rather his computer, and send it to him. And so starts the magazine down the rails. I like this approach as it allows more time to gather the latest news and get it out.

There seems to be a lot of questions about who came first in the "discoveries", Bob Coopers' word, in this industry. Quite honestly I'm getting real sick of it.

LIKE:

Did Tay Howard or Paul Shuch come up with the first receiver designed with the 564 PLL? According to Cooper, Tay Howard. My opinion is who cares. Both radios were ok for their day. Both were based on Steve Birkills' data.

Both are antiques. If you don't think so look at, Shuch designed, ICMs performance, over the last year. The 4200 was the best thing they ever did. But not profitable enough so they cheapened it into the 4300A, which was almost the worst they ever built. So bad that they suspended production on the radio for over three months. Cooper didn't tell you? They have now followed this with the new 4000. I haven't had hands on experience with this one, I did the other two, but the word is it's almost as good as the 4300A. I will try to obtain one and test it in an upcoming issue.

The, Howard designed, Satellite Supplies, radio has as yet to please anyone. Rumor has it even Howard. I will also target this one for a review. Rumor goes on that "someone" is trying to unload these at "cost" or less. I did see one of these up close, I think it's a giant step backward. After 25 minutes of tweeking the picture was worse than the bad one he started with. And they're all tested with the wiz machine.

Lets face it technology has passed them both by.

One thing they both have, interestingly, in common now is the $25 "hybrid". Wanna make one. Get a piece of pc board, some chip caps and resistors, some excess resistor leads (to use for pins), a 10131 and a 564 IC. Put the $3 dollars worth of parts on the pc board, comformally coat and allow Cooper to call it the "miracle" circuit. By the way it's $25 at the 1000 piece quantity. I'd rather be able to take it out of the socket if it blows up than pay that much and unsolder all those pins. But I'm rambling aren't I.

Next question: Who "discovered" the divide by two circuit and how to use it Tay Howard or Microwave Associates? According to one of the experts in the field, again Cooper, Tay Howard. No matter how much you root for the little guy it wasn't. Microwave Associates did it in their VR3 series in 1979, and if it was in a production radio then it was a lab reality, typically, three years earlier.

And now the current chicken and egg question? Who built the first electronic rotator Bob Luly or Dave Yanko? Both are close friends of mine. Dave helped me "sneak" into the Houston show, Cooper wouldn't let me exhibit, to show that my radio did as good if not better than anyones. Yes those are mine next to the "boy scout cups" in the picture, actually one belonged to a customer who brought it all the way from Missouri to show "Coop" that it worked. Any way file that under "Coop didn't tell us". (THere's a lot more and you'll get it in the months to come, I'm not political). Bob Luly has given seminars etc. And for a while I had one of his original "pop up" antennas here.

Coop's answer seems to be Bob Luly. Again he is speaking as the showman and not factually. I am not going to give you the direct answer. What I am doing is to go thru how this product came about and let you answer this question for yourself. In this case I happened to be directly involved.

At the San Jose SPTS Bob Luly, Dave Yanko, Georgia Rohner, Nelson Either, Norm Gillespie, Hayden McCullough and Myself got together, somehow, for dinner.

This dinner started with the usual idle conversation at about 8 PM. Several hours, and much coffee, later we were discussing items within our various expertices. This lead, a few more hours and coffee cups, later to a discussion of where the industry was going. We started dreaming and discussing what might be possible. I asked if we couldn't rotate the signal electronically. Bob mentioned he had heard of such a thing used in radar. We tossed around how nice this would be. All who remained at this time was Bob, Dave, Georgia and myself. It was decided someone should persue this idea. I was busy with my radios. Bob was busy with antennas. Dave was busy with feed horns and mechanical rotators. So who did it fall on? Dave. Georgia was busy with pc boards, casting molds etc. Dave was the logical choice.

After some research we found that it had been done by the government in 1952 for use in radar in the jets of the Korean war. And at least one manufacturer made a device similar, and very expensive, for laboratory use. So we knew it could be done.

Lots happened. Bob had trouble getting going. Dave couldn't get his mechanical rotor to work right. I spent nearly $60 thousand dollars trying to get my "digital" radio, and its' subcontractors, to run to my specs. Someday I'll have to tell you that "horror" story. Anyway, after months, Bob finally got the right material and got going, I opted for a simpler radio and got going, and Dave finished his line of feed horns. So now we had been thru the start up terrors. Now we needed production. Dave squeezed time to work on the electronic rotator.

The idea was for Dave to develop and manufacture it and Bob to market it and for me to develop a new radio to be sold with it and maybe Bobs antenna. As in all Grandiose plans it didn't come out that way.

When Dave got the product running he needed money to produce it. Bob had been courted, but never married, by capitalists. I was getting jumped on by my "friend" Cooper, which knocked my business back each time (first time I lost nearly a hundred thousand in lost orders or non collects, second time only half that but most of that in bad checks (stop payments) after delivery, get the idea who pays attention to Coop). So neither of us were able to help. Dave then did what he had to do, broke the agreement. Bob got frustrated as did I. Bob designed one of his own and I suppose I might have done the same, I did tell the amatuer net how and Ken Rae (WBOPOP) has, but I hate to design the wheel any more times than necessary and it had just been done twice.

Dave now has the capital needed to produce and so does Bob. Both are producing. Last week I got one from Dave. I am supposed to get one from Bob shortly. With a little luck I will report on each shortly. So thats the story, in its entirety, as I remember it without the politics. The answer seems to be the government.

So much for whos on first. As in nearly all cases of product development no designer "discovers" anything new. Discovery belongs to the expensive guys with no pressure that sit in the think tanks. Not the orchestrator of products who is under pressure from budget, production and sales for a newer better thingy with more bells and whistles and at 1/3 the production cost of their nearest competitor. I am fond of this fellow for I are one. I've spent a good portion of my life under these pressures and no college professor can ever understand nor teach what it takes to do it. And there are few who do it well.

Next month I will probably talk a little about the kettle, Cooper, calling the pot, me, black. I would like to bring only one point out for all of you who will be going to SVS to support Mr. Cooper. A ROUGH financial data package. Consider an attendence of 4000 persons and 50 booths. 4000 times $150 is $600,000 and 50 times $750 is $37,500. Total $637,500 for each show before the income from rooms, tapes, and those lousy "manuals" and other incidental things. At four shows per year we support him with $2,550,000, yes TWO and A HALF MILLION, dollars. Which he takes to the West Indies and maybe pays tax. I am using conservative, my numbers are 20% less than he says attended, numbers. The speakers still don't get paid.

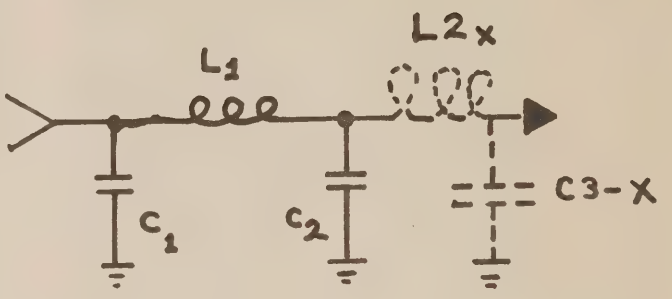
Ahh so much for this months ramblings.

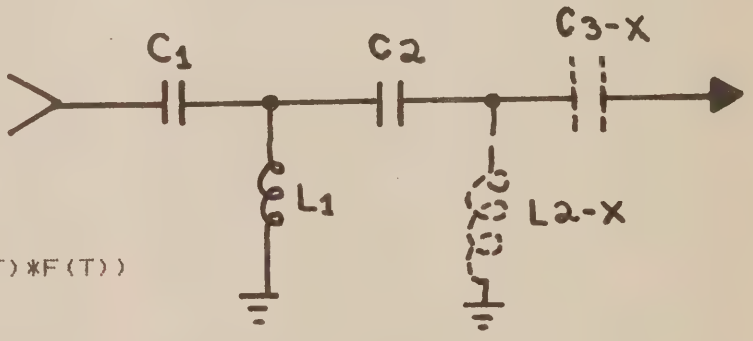
Any of you who are amatuers the satellite net is on Sundays at 1 pm Central time. Check in if you like. Otherwise join us in the NET after the NET at 2 with WBOPOP, myself and lots of other regulars as we cuss and discuss ideas, designs and equipment. If your not a ham you can listen. Most multiband radios have the frequency. This sometimes goes until 5 pm.

Growl. Thats from George must mean I shot my time. See Ya next month. J.P. ROHNER. ed.

```
10 REM RFFILTR   filter a file set
20 DIM A(13),C(13),L(13)
30 DIM F(13),S(28)
40 INPUT "ENTER POLES (1 to 13)";NN
50 IF NN<0 OR NN>13 GOTO 40
60 INPUT "ENTER RIPPLE  (.1 to 8)";R
70 IF R<.1 OR R>8 GOTO 60
80 N=NN
90 Y1=LOG(10)
100 Y2=.1*R
110 Y3=Y2*Y1
120 Y4=EXP(Y3)
130 K=SQR(Y4-1)
140 P=1/K
150 Q=LOG((2*P+SQR(4*P*P+4))/2)
160 D=Q/N
170 W=(EXP(D)-EXP(-D))/2
180 FOR M=1 TO N*2+1
190 S(M)=SIN((M/N)*(3.1415927#/2))
200 NEXT M
210 FOR U=1 TO N
220 M=2*U
230 F(U)=(W*W)+(S(M)*S(M))
240 NEXT U
250 A(1)=(2*S(1))/W
260 IF N=1 GOTO 320
270 FOR T=1 TO N-1
280 T1=(2*T)-1
290 T2=(2*T)+1
300 A(T+1)=(4*S(T1)*S(T2))/(A(T)*F(T))
310 NEXT T
320 P=3.14159
330 P2=2*P
340 INPUT "LOAD IMPEDANCE in Ohms ";O
350 IF O=0 THEN GOTO 340
360 PRINT "ENTER TYPE OF FILTER REQUIRED"
370 INPUT "1 = Low Pass 2 = High Pass 3 = Band Pass";C
380 IF C<1 OR C>3 GOTO 370
390 IF C=3 GOTO 830
400 INPUT "ENTER CUTOFF FREQ  (Mhz)";F
410 IF C=2 THEN GOTO 740
420 REM low pass picture gen goes here
430 M=1
440 FOR I=1 TO N STEP 2
450 C(M)=A(I)/(P2*F*O)
460 IF A(I+1)=0 THEN 490
470 L(M)=(A(I+1)*O)/(P2*F)
480 M=M+1
490 NEXT I
500 FOR I=1 TO N
510 IF C(I)=0 THEN 560
520 CD=C(I)*1E+06
530 PRINT "C";I;" = ";CD;"      ";
540 IF L(I)=0 THEN 560
```

figure 1 Low Pass





High Pass

figure 2

```
550 PRINT "L";I;" = ";L(I)
560 NEXT I
570 PRINT " "
580 PRINT "POLES=";N
590 PRINT "RIPPLE=";R;"CUTOFF FREQ=";F;"IMP=";O
600 OPEN "O",1,"FILTDATA"
610 PRINT #1,C,N,R,F,O,FC
620 FOR I=1 TO 13
630 CD=C(I)*1E+06
640 PRINT #1,CD,L(I)
650 NEXT I
660 CLOSE
670 RUN "STANDVAL"
680 FOR I=1 TO 13
690 C(I)=0
700 L(I)=0
710 A(I)=0
720 NEXT I
730 END
740 REM high pass picture gen here
750 M=0
760 FOR I=1 TO N STEP 2
770 M=M+1
780 C(M)=1/(P2*F*O*A(I))
790 IF A(I+1)=0 GOTO 810
800 L(M)=O/(P2*F*A(I+1))
810 NEXT I
820 GOTO 500
830 REM band pass picture gen here
840 INPUT "LOW CUTOFF FREQ (Mhz)";FC
850 IF FC=0 OR FC>200 GOTO 840
860 INPUT "HIGH FREQ CUTOFF (Mhz)";FD
870 IF FD=0 OR FD>250 GOTO 860
880 IF FC2<FC1 THEN PRINT "high less than low":GOTO 840
890 FA=SQR(FC*FD)
900 FB=FD-FC
910 M=1
920 FOR I=1 TO N STEP 2
930 C(M)=A(I)/(P2*FB*O)
940 L(M)=1/(4*(P*P)*(FA*FA)*C(M))
950 M=M+1
960 IF A(I+1)=0 GOTO 1010
970 L(M)=(A(I+1)*O)/(P2*FB)
980 C(M)=1/(4*(P*P)*(FA*FA)*L(M))
990 M=M+1
1000 NEXT I
1010 GOTO 500
```

Some of you are probably asking why I'm using full page to present this program when everything else is two column. Computers are very fussy about where you cut off their instruction lines. And if you're going to use this program and the ones to follow, you must enter them right. I won't answer the phone at 2 AM like I did when Cooper screwed up the one I sent him. Now that the disclaimer has been set, on to how it works.

This program is part of a set that generates Chebechev (I hope that's spelt right) filters. This program computes the L, inductance, and C, capacitance, required to build low, high or band pass filters. The program next month will convert these values to standard values and scan the projected response of the low pass filter. Until then use a catalog to convert to nearest value.

Figure 1 is low pass and figure 2 is high pass. The band pass is a special type and will be covered at a later date. Note that the term POLES is not used in the "quasi" classical sense but rather to denote number of total elements. Normally a pole is considered, in low pass filters, as 2 caps and 1 inductor unless its the second etc. pole which is one and one. This gets complex and Fortran handles this nicely. Basic is not as flexible so to keep all things simple we use elements. This also simplifies your job. All filters are based on odd elements, 3, 5, or 7. I really do not know what will happen if you give it an even number. I do know the filter will fall on its nose.

This program has historically been within .5 db of it's predicted results. Once the low pass filter scanner, next month, is in place you can test it.

The program was written in Microsoft Mbasic but should be easy enough to transport if your basic has the capabilities. It will ask you the needed questions.

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Satellite Contest

"To commemorate the launch of RCA's new F3R satellite, Coop's Satellite Digest is sponsoring a contest for satellite enthusiasts all over the world. The 48 hour contest will begin January 1, 1982, a period during which people with satellite terminals will be encouraged to see who can receive and log the greatest number of separate video and audio feeds and transmissions. Participants will compete in three categories depending on their type of dish and a wide range of plaques, certificates, and equipment prizes will be awarded. Suppliers are invited to participate in this promotional opportunity by sponsoring a prize plaque or donating equipment for prizes. All companies donating equipment for prizes will receive an equal value amount of advertising in Coop's Satellite Digest.

SATELLITE TELEVISION TECHNOLOGY
PO BOX G ARCADIA, OK 73007

This is Mr. Cooper's "LATEST" ploy. My question is how is he going to validate anyone who happens to be equipped to decipher the 350000 plus telephone channels available constantly. I assume they fit under the "audio feed and transmissions". In 30 minutes a person could log several thousand data channels if equipped with a computer and a modem. How is he verifying these. Or is this (like the "Pioneers" 10%) just another way to milk the public. YOU DON'T WANT MY OPINION. It might be interesting to see if I really would get "AN EQUAL VALUE AMOUNT OF ADVERTISING", whatever that means.

ED. Sorry George.

Another One Bites The Dust

As you all should be aware California Microwave bought out Dexcel to obtain their GasFET production and slowed down deliveries.

Now, Comsat General Corporation has announced plans to acquire Amplica, a California microwave equipment company, for $57 million. Amplica, based in Newbury Park, outside of Los Angeles, has reported a substantial percentage of sales in producing microwave amplifiers that are used widely for satellite earth stations, a Comsat spokesman said. The spokesman added that the acquisition was due to Comsat's interest in the growth of direct broadcast satellite services. "When DBS becomes operational on a subscription basis, there will be a large demand for satellite earth stations, which will need amplifiers."

California Microwave/Dexcel

California Microwave, Inc., posted fourth quarter earnings of $875,000 or 17 cents a share, a two-fold gain compared with the net of $404,000 or 10 cents a share, reported for the like period a year ago.

Sales were $16.9 million, up 56.3 per cent from $10,816,000.

During the fiscal year ended June 30, CMI reported earnings jumped to $2,521,000 or 53 cents a share, from $158,000, or 4 cents a share, reported for fiscal 1980.

Sales of $56,971,000 were up 50 per cent over $38,066,000.

Per-share earnings reflect the company's two-for-one stock split distributed on June 15. The split increased the number of CMI shares outstanding to 5,289,000.

The firm reported a 1981 year-end backlog of $59,282,000, double the previous fiscal year-end total of $28,278,000.

So why is this news. Remember this company just bought Dexcel.

Pirates Pay

Companies large and small are successfully winning their lawsuits or being awarded judgements against pay TV pirates and signal snatchers. The latest winner is the biggest pay program service, Home Box Office. Distributors of microwave antennas intended for use in stealing pay service have been ordered to pay HBO $10,000 after being found guilty of contempt of court.

The contempt judgement, entered last week by U.S. District Judge Abraham Sofaer, directed defendant "Advanced Consumer Technology" and its president to pay the ordered amount for having "willfully violated" the court's previous orders to refrain from "promoting, advertising, selling, distributing or in any other way making available equipment capable of receiving the pay television service of HBO."

John Redpath, HBO vice president and general counsel, called the order "a victory for HBO," adding that such a decision was evidence of the company's continuing efforts to prosecute piracy of HBO's signal. "We intend to bring additional suits against others who are stealing our signal in the New York area and elsewhere," Redpath noted.

HBO initially brought suit against Advanced Consumer Technology and others last January, charging the defendants with distributing microwave antennas used to steal the programming signal. A decision on the merits of the case is still pending before Sofaer.

Satcom III-R Delayed

This month's launch of RCA's Satcom III-R satellite has been postponed as a result of reshuffling the satellite launching timetable by the National Aeronautics and Space Administration. The launch of Satcom III-R has been moved back from October 29 to November 19, with the launch of Satcom IV, originally set for December, now delayed until January 12, 1982, an RCA spokesman said. Certain technical problems had caused NASA to push back the entire launch schedule, delaying the send-off of both RCA birds, according to the spokesman. It is expected that due to another failure in the PAM module that the November launch may actually occur in January. "Don't hold your breath" is the latest advice I have from friends within NASA and the contractors.

Spotlight Is On

It's been no secret, that eventually, Times Mirror would likely market its Spotlight programming service industry-wide. But announcement of that may come sooner than expected. Though Harry Chandler, vice president of program development for Times Mirror Satellite Programming Network, denied it, rumor has persisted that the service launched only in T-M systems last spring will soon be marketed to all systems as a competitor to Cinemax.

This is an interesting news item from the standpoint that most of us have been watching this since Sept. 1. When it found its home on SATCOM F1 transponder 19. After watching it I must admit now instead of spending all my time on the Movie Channel, I am spending about equal time bouncing between the two.

I do wish HBO would scramble. That way I wouldn't keep stopping to see if they're doing anything with their 6 to 8 hours a day. Actually the teleconferences and test patterns are useful to set up receivers with. Other than that, "PHUGH."

Oops, I didn't mention Showtime. That's where you see most of what's going to be on HBO a month or so later in the way of specials etc. It is a fine service, and not near as redundant. You do get real tired of stories in black and white, as Cinemax.

HBO says it will finally join the 24 hour a day group in January. What a waste.

LPTV?

Is low-power TV a concept whose time has not yet come: or has its time actually come and gone? The FCC may be readying to impose yet another freeze on the "not quite ready for prime time" service. One obvious reason, of course, is the budgetary limitation being placed upon the commission by the Reagan administration making it difficult for staff to deal with the avalanche of applications. Some sources suggest, however, that the budget is a convenient excuse and that the current commission simply does not share the same enthusiasm for low-power's potential that its predecessor did.

TV-Sat In Europe

It will be ingenious, if it works, but high-definition TV is just talk at present. Exhibited in Berlin were small dish antennas suitable for rooftop mounting, so that viewers can receive satellite broadcasts directly. But this doesn't mean that direct broadcasting satellites (DDS) have arrived in Germany, or are about to.

But development is proceeding. The French and German governments are cooperating in building TV-SAT, which will be launched in late 1984. It will allow the transmission of three TV channels, or two TV channels and 16 stereo digital radio programs, which could be received by 90-cm dishes. However, TV viewers won't get much out of it.

TV-SAT has been designated an experimental satellite, and it will be used for "preoperational service" for a two-year period, only measuring signals may be transmitted over one channel. The other two can be used for television, but only to send out the existing programs in unaltered form. It will be the 1990's before the Franco-German DBS plan moves into full operation with a new five-channel satellite. Nonetheless, there were plenty of 90-cm dishes in Berlin.

NOW?

It's almost finger-crossing time at RCA Americom. The scheduled November 19 launch date is fast approaching for Satcom III-R and the bird itself has been shipped to Cape Canaveral for final launch preparations. But further delays are not entirely out of the question. "The only thing that could possibly hold it up now other than a natural disaster, of course, is (having) a shuttle slip into our week," said John Williamson, RCA spokesman. The second voyage of the space shuttle is slated for November 4. If that goes off without incident, everything will be "go" for the errant Satcom III's replacement. If Satcom III-R ends up in geosynchronous orbit 22,300 miles above us, Satcom IV will be launched January 12, 1982. As for insurance, RCA officials were reluctant to comment.

SBS, Tymnet Seek FCC OK for DTS Networks

Satellite Business Systems (SBS) and Tymnet Corp. last week became the second and third companies to request FCC authorization to build and operate so called digital termination systems (DTS) to provide local distribution facilities for customers of their existing long-distance networks.

ISA Communications Services was the first to submit such a proposal after Xerox abandoned its plans to build the Xten cellular radio-based network that would have allowed customers to bypass local telephone loops.

While the ISA network costs were estimated at about $21 million, and Tymnet told the commission its system would be priced at about $65 million, an SBS spokesman last week said the satellite carrier could only estimate its DTS network costs "somewhere between those two figures."

According to the SBS application, the proposed, 32-city DTS network would be used to augment the current SBS system, enabling the company to provide microwave radio channels for the collection and distribution of digital wideband communications traffic among users in metropolitan areas.

"The original SBS concept, that of delivering large communications capacity directly to a customer's premises through the use of easily placed earth stations, was a major step in solving the last-mile barrier for a very large business," said SBS president Robert Hall.

"The addition of digital termination systems, using the satellite network as a backbone, will extend than solution to the communications needs of medium and small users."

To provide the proposed DTS services, SBS will install 2-foot-diameter antennas and associated 10-GHz terminal equipment on the user's premise. That equipment, to be acquired from Digital Communications Corp., will be aimed at a central transceiving station which will be interconnected with an SBS earth station in or near each metropolitan area.

The proposed service, dubbed Data Exchange Service, will enable SBS to provide switched or nonswitched data channels at speeds ranging from 2.4 kbps to 1.544 Mbps.

SBS told the commission it expected to begin Data Exchange Service in mid-1983, initially among Chicago, Dallas, Los Angeles, New York and Washington.

The company said 27 other cities would be added gradually, with all 32 in the system by the end of 1986.

Tymnet noted that all equipment to be used in its proposed DTS network has been designed and/or selected by Digital Communications Corp., a subsidiary of M/A-Com, Inc.

Shared Facilities

According to Tymnet's application, all proposed facilities, with the exception of relatively inexpensive DTS user equipment, will be shared among customers possibly attracting lower-volume users.

DTS services will be offered both separately from and together with Tymnet's other data communications services and will include document distribution, teleconferences and high-speed data transmission.

The company said it planned to complete construction of the DTS station within 5 years of receiving FCC authorization.

Now in negotiations with satellite carriers and equipment vendors for the additional facilities needed for the proposed DTS network, Tymnet said it expected such discussions to be completed by the end of this year.

RCA Seeks 5th Bird

RCA Americom Communications said it has requested FCC authority to launch a fifth operational satellite in August, 1983.

The RCA domestic carrier, which wants to place the communications spacecraft at 66 degrees West longitude, already has permission to build the satellite but the green light on launch and operation was deferred by the FCC pending a demonstration of customer needs.

According to RCA Americom, which is competing with other carriers for a scarce number of orbital slots, increased satellite demand warrants the FCC authorization.

RCA Americom currently offers long-haul transmission services via 55 satellite transponders, 43 of which are part of its own Satcom I and II spacecraft, and 12 leased from other satellite carriers' systems such as AT&T Comstar.

HTN Plus

Seeing a "void" in the cable industry for a "midi" programming service, Group W has created Home Theater Network Plus, a 12 hour, seven day per week family-oriented offshoot of the "mini" Home Theater Network it acquired late last year.

Like the three-year-old HTN, HTN Plus will feature only G and PG rated entertainment. Premiering January 1, 1982, the new service will be delivered on a separate transponder from HTN. The satellite and transponder, however, have not yet

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been revealed.

Beginning at 4 p.m. Eastern Time, HTN Plus will deliver four feature films each day plus three travel segments. There will be a minimum of two different movie titles shown each evening. One travel segment will be HTN's existing Travel Channel. The second, Travel Magazine, is currently under development. The third will be a later showing of the magazine show.

Though there may be some overlap in programming between HTN and HTN Plus, the two services are being created as separate, compatible tiers. Each will feature different prime-time programming and have individual program guides.

HTN Plus will be sold to cable operators for $2.95 with a suggested retail price of $6.95, compared to the $2.00 operator fee and $3.95 to $4.95 subscriber price tags the HTN "mini" carries.

"As we see rate increases by the maxi service, it becomes evident that there is room in the middle for a "midi" service. One that allows a high margin for the operator," said Peter Kendrick, president of HTN. "Cable companies face huge expenses for new cable construction. Pay services must recognize this and allow the companies sufficient margins to make pay services economically feasible for the operator."

As for the programming, Kendrick states that a survey completed last month shows that 67 percent of HTN families said it was "important" to have a cable service specializing in movies suitable for everyone in the family. Over half of the families said it was "very important." In addition, travel came in second to movies as the kind of programming subscribers wanted more of.

Early evening scheduling on HTN Plus, whether movies or travel features, will cater to children. Kendrick states that Group W does not currently have plans to expand HTN Plus to a 24-hour format, but that if consumer demand warrants it, it is a possibility.

Kendrick expects "most" of HTN's current affiliates will opt for the new service. HTN "mini" is carried on 200 cable systems, representing 140,000 subscribers.

Intelsat Orders More Satellites

The exploding demand for international telecommunications in the Atlantic and Indian Ocean zones has caused the International Telecommunications Satellite Organization to double its order for Ford Aerospace & Communications Corp's series V-A satellites to six. The new order with the company's Western Development Laboratories in Palo Alto, Calif., will cost the Washington-based consortium of 106 member nations about $75 million plus orbital incentive payments and inflation provisions. Each of the six Intelsat V-As, scheduled for launch beginning in 1983, can carry up to 15,000 simultaneous telephone calls plus color-TV signals. These birds, plus nine earlier V series from Ford, are expected to serve until the Intelsat VI series, with a 40,000-call capacity, is available in 1986.

NCTA Study on Dishes

A new study produced by the NCTA evaluating the effectiveness of three-meter dish antennas for the reception of three-degree spaced C-band satellites was submitted to its Engineering Committee last week and that the NCTA will stand behind its claims of last year that three-meter dishes won't hack it. Moreover, the NCTA claims to have substantial engineering test results to back them up.

Earlier the National Cable Television Association had jumped into the fray over whether three-degree spacing and three-meter diameter dish antennas were compatible for quality viewing on the home TV set. The NCTA's vice president for science and technology at that time, Christopher Weaver, stated that with the possibility of FCC approval of three-degree spacing of satellites on the earth's geosynchronous orbit, "three-meter antennas could become totally unusuable." Some manufacturers of antennas took exception to Weaver's remarks, claiming they were without foundation. "There is no data to substantiate it," countered Prodelin, Inc., President David Bondon. "According to my information, it (the NCTA technical document) is based on hypothetical evaluation of a three-meter dish." Prodelin is a principal supplier of three-meter dishes.

Technically the testing problem comes down to subjective evaluation of picture quality relative to measured carrier-to-interference (C/I) ratio as expressed in decibels (dB). In other words, place a group of people in front of a good TV set, turn it on and transmit to the set pictures with various measured amounts of decibels of the kinds of interference known to be produced when one receives signals from satellites with three-degree spacing to earth station antennas of various diameters including the three-meter dish.

And that's just what engineers at RCA Americom did. The NCTA Subcommittee on Satellites' report on three-meter dishes draws its data from the RCA Americom study authored by Walter H. Braun of RCA Americom.

It is the view of the author of the forthcoming

NCTA report, Norman Weinhouse, chairman of the NCTA Satellite Subcommittee and manager of satellite earth terminals at Hughes Microwave Communications, that the RCA Americom research is conclusive and vindicates the NCTA position of last year. Neither RCA nor Hughes are marketing three-meter dishes for C-band reception, Weinhouse said.

According to Weinhouse, "Weaver's statements were not controversial at all but factual statements. His word was reported by solid engineering analysis. Weinhouse went on to say that Bondon of Prodelin, Inc., "did not back up his claims with engineering data." The conclusion seems to be that a three-meter antenna just won't hack it. "The original NCTA statement has not changed," Weinhouse said.

While Weinhouse's Subcommittee report passes negative judgement on three-meter dishes for the C-band (4 GHz), Weinhouse and Hughes Microwave Communication is bullish on even smaller dishes for Ku-band (12 GHz) reception. In the test of the Hughes-manufactured Satellite Business Systems (SBS) satellite employing Hughes receiving equipment on August 25, the downlink was 12 GHz. With the Hughes equipment, "antennas of two meters diameter would provide good performance," according to Weinhouse. "In fact," he continued, "if the transmission parameters are selected with care, even smaller dishes of 1.4-meter diameter could be used effectively." The higher Ku-band satellite frequency allows for smaller dishes. "I'm an advocate of small dishes; the smaller the better," Weinhouse said.

SBS-2

SBS-2, a 12 ghz communications satellite launched September 2 from Kennedy Space Center, has been placed in a near-geosynchronous orbit and is presently being drifted towards its final orbital station. The final orbit will be reached about October 28. On September 28, SBS engineers completed such in-orbit deployments as release and despinning the communications section, raising the antenna reflector, and lowering the extendible solar panel skirt. These modifications were performed by the COMSAT launch control center, with control assumed by the SBS Beacon & Command Station, Castle Rock, Colorado.

The president of SBS, Robert Hall, pronounced the mission "highly successful," and said that the satellite represents "a significant milestone." The SBS-2 satellite will provide three significant service contributions, according to Hall. He enumerated these points: SBS-2 will provide full redundancy in the event of an SBS-1 failure: it will double SBS's capacity for customer growth, and it opens up the possibility of leasing preemptible transponder capacity for specialized uses. SBS-2 will be available for commercial service early in 1982.

China's Satellite

Using a "Long March III" rocket, the People's Republic of China launched a 3-in-1 (three satellites on one carrier) rocket in mid-September. The rocket used liquid hydrogen and oxygen propellants similar to those employed by NASA and the European Space Agency (ESA). Limited details of the launch were released by Xinhua (the official P.R.C. news agency) which stated that the satellites are studying "physics experiments" and are sending continuous streams of information to earth. All systems are functioning normally.

The first Chinese rocket with a satellite payload was launched in 1970, with seven others launched over the next eight years. This marks the first time China has launched three rockets on one carrier rocket.

Bell Sat TV Tariff

The Federal Communications Commission last week rejected as unlawful AT&T's satellite television service tariffs, but told the carrier it could file a revised proposal if it wished to do so.

Originally filed last January, the satellite TV transmission service tariffs outlined a 3-year trial program that would have been limited to five transponders and required customer use at AT&T provided earth stations.

The commission suspended the proposed tariff and ordered AT&T to justify those limitations and to explain further its rate-making techniques that may have discriminated between full-time and part-time users.

In response to the FCC suspension of the tariff, AT&T then proposed to provide the programming distribution service on an open-ended basis and to unbundle the transmission-ground segment rate element for full-time customers.

The carrier still planned, however, to offer occasional-use service on a bundled basic that would require customers to lease both space segment capacity and earth station facilities from AT&T.

AT&T also filed with the commission additional information on how the total costs of the satellite are allocated among transponder.

In its rejection order last week, the FCC ruled that most of AT&T's revisions satisfied the commission's

original concerns, but that continued bundling of occasional-use rate elements resulted in an unlawful tariff.

FCC Oks Bell Sat TV Tariff

AT&T has received FCC approval of a revised satellite television transmission tariff, which the carrier changed by unbundling charges on the space segment and ground facilities for fulltime users and eliminating provisions for part-time services.

Under the revised tariff, NBC will be the first commercial network to use AT&T's transmission facilities sometime this month.

CBS and ABC television networks also have signed contracts for satellite distribution of TV programming. The National Entertainment Network and Robert Wold Communications also have reached agreements with the Bell System for satellite distribution of TV programming.

Originally, the FCC rejected as unlawful AT&T's tariff, which would have required both full and part-time customers to use AT&T provided earth stations along with the communications satellite capacity.

AT&T subsequently unbundled the full-time user provisions but refused to do so for occasional-use customers.

The commission again rejected AT&T's revisions but told the company it could file a modified tariff that attempted to justify the different treatment of full and part-time customers.

AT&T subsequently opted to eliminate the provision offering satellite transmission service on a part-time basis, and the commission allowed the tariffs to go into effect.

Western Union

The FCC also approved Western Union's application to build a sixth Westar satellite, valued at $28 million, but deferred action on the carrier's request for orbital assignment and launch authorization pending the outcome of the commission's Second Generation Satellite rulemaking.

Western Union has purchased all its Westar units from Hughes Aircraft and now operates three in-orbit satellites and has been authorized to launch two more.

The company said it sought permission for a sixth Westar unit because the first two are coming to the end of their usual lives and traffic demands are increasing.

The earliest Westar VI would be available, according to Western Union, would be mid-1983.

RCA Seeks 5th Bird

RCA Americom Communications said it has requested FCC authority to launch a fifth operational satellite in August, 1983.

The RCA domestic carrier, which wants to place the communications spacecraft at 66 degrees West longitude, already has permission to build the satellite but the green light on launch and operation was deferred by the FCC pending a demonstration of customer needs.

According to RCA Americom, which is competing with other carriers for a scarce number of orbital slots, increased satellite demand warrants the FCC authorization.

RCA Americom currently offers long-haul transmission services via 55 satellite transponders, 43 of which are part of its own Satcom I and II spacecraft, and 12 leased from other satellite carriers' systems such as AT&T Comstar.

The RCA unit maintained that existing commitments to customers will fill an additional 55 transponders while growth will require another 10 transponders during the next few years.

RCA said that the construction of the fifth satellite is under way and NASA has an available Delta launch slot open in August, 1983. The firm's satellites are being built by its RCA Astro-Electronics subsidiary, also based in Princeton.

RCA Americom said it has authority to build six satellites and launch four.

Two of their satellites, designated Satcom III-R and IV, are expected to be launched during the fourth quarter. The firm lost a satellite that was launched in late 1979. Satcom I-R, the fourth authorized launch, is scheduled to be sent into orbit in the Spring of 1983 to replace Satcom I at the end of its service life. Satcom I and II date to 1975 and 1976, respectively.

Another satellite, which is expected to be dedicated to long-distance traffic of RCA's former Alascom, Inc., subsidiary, is slated for launch in October, 1982.

Much of the new satellite capacity is expected to be devoted to cable TV transmissions, although RCA Americom also provides services to government and other commercial users.

RCA recently also asked the FCC for permission to construct, launch and operate what it called an experimental system of so-called direct broadcast satellite for distribution of programming directly to individual and community receiving stations.

The $760 million project would consist of four operational satellites and two ground spares in the 18-24.6 Ghz K-band.

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VCR Is Criminal!!! Audio Tape Recorders?

In a landmark reversal that could have far-reaching repercussions on the healthy sales of videocassette recorders, the U.S. Ninth District Court of Appeals ruled last week that copying television programs off the air is a copyright infringement, even when performed in the private home.

The court ruled that manufacturers and retailers of VCR's may be held in liable for having supplied the equipment, but stopped short of enjoining sales of Betamax recorders manufactured by Sony Corporation, one of the defendants. Sony, four retailers, an advertising agency and a private citizen have been sued by Universal City Studios, Inc., and Walt Disney Productions, Inc.

"We are extrememly pleased that our efforts to pursue this matter have been vindicated," said a Disney representative. "Because this is a landmark case of such importance to the motion picture industry, we have no further comment until the documents are read."

The decision, made by a three-judge panel here, is a reversal of an earlier lower court ruling. The court said "damages of some kind were appropriate" and recommended the establishment of continuing royalty payments by recorder manufacturers to producers of copyrighted programs.

Frank McCann, vice president of public affairs for RCA Consumer Electronics Division in Indianapolis, told CableVision that royalty costs would "naturally" be passed on to the consumer.

In deciding that manufacturers and retail store owners are liable for copyright violation when VCR owners tape television shows, the appellate court declared that "the corporate appellees 'know' the Betamax will be used to reproduce copyrighted material."

McCann said a number of other uses, such as home movie-making have superceded taping off-air as a consumer motivation for buying VCRs. However, a survey of industry experts revealed that a significant number of households surveyed selected the ability to record movies off TV as important in purchasing a VCR.

In a prepared statement, Sony said it "strongly disagrees" with the court's decision as interfering with public enjoyment of the "fastest growing consumer electronics product in history" and is preparing to take the case to the Supreme Court. Sony's decision is backed "all the way" by the Electronics Industries Association, says Sony Senior Vice President Jack Wayman.

"The studios are making millions off VCRs selling old movies they never would have used. What's a little home recording?" Wayman said.

Representative Stan Parris (R-VA) has introduced legislation that would allow the continued sale and use of home videorecorders. Parris introduced the legislation in response to a ruling last week by the Ninth Circuit Court of Appeals in San Francisco. The court reversed an earlier court decision, stating that the use of home videotape recorders constituted copyright violations. Parris said he introduced the bill "to halt an unnecessary and unwarranted intrusion by the federal courts into the private homes of three million Americans." He also termed the appellate court ruling "the latest example of idiocy in the federal judiciary."

To this story I would like to add that I agree with both Mr. Wayman and Rep. Parris. The copyright law is why we are called pirates and seems to be the way another agency gets funded. If this ruling stands then all of us who have recorders become instant criminals.

The question in my mind is: If video recording is illegal then is audio recording illegal? And if so then taking pictures of anything without its permission must also be illegal. Which in turn would make anything you see or hear illegal, ad infinitum.

I can't believe that the recording from television is any different than recording from records or radio. And the record companies are in better shape than the movie studios. I keep thinking of the drowning man grasping at straws. For my part they'll have to come and arrest me to keep me from building a library that someday I will be able to show my grandkids. ED.

On The Block?

RCA Americom has filed its second transponder allocation plan in as many weeks with the Federal Communications Commission. If approved, the latest scheme would allow the common carrier to auction off the 13 remaining slots on its Cable Net Two.

The Cable Net Two customers are those which will find a geosynchronous home on Satcom IV after it is launched January 14, 1982. Currently, nine Cable Net Two customers are using transponders on Comstar D-2, temporary bird leased from AT&T. Although there will be 24 transponders on the Satcom IV, two slots will be kept open for emergency use.

Two weeks ago, RCA filed its first new tariff plan, a first come, first served method of allocation. In that filing, RCA said that the plan would take effect on December 15, if approved, unless another plan took

precedence. RCA officials have indicated that the auction plan filed last week is the preferred method of allocation.

In order to participate in the auction, interested parties must give RCA a deposit of $100,000. If a client does not bid high enough to win a transponder, the money will be refunded. For those fortunate few who are successful in the auction, the amount bid will be "considered to be a non-refundable deposit which will be credited to the monthly service charge for the fixed term transponder service requested." In other words, the client must pay the full amount bid up front to RCA, which will pay itself a monthly fee from the sum.

If a customer bids higher than the amount now needed to lease a fully protected transponder through 1988 ($120,833 per month), whatever is left over is "non-refundable."

"We feel the auction sets a fair value on the transponder itself," said RCA spokesman John Williamson. "We indicated in the filing that (some) of the customers have in fact auctioned off their rights to the transponder without any regulatory problem."

Report Favors Bids

A 44-page economic report released by the Federal Communications Commission last week could provide the practical framework for future decisions in allocating satellite transponders and orbital slots to competing firms.

With the growing demand for domestic satellite service, the commission has realized the immediate need to modify or adopt a new transponder allocation policy to meet the limits of the orbital spectrum.

Despite the scarcity in the number of transponders available, the report favors transponder auctions rather than allocation by government decree. The report, written by Charles Needy of the Common Bureau in response to a request by Commissioner Anne Jones last January said that an auction would rely on competitive forces, while an allocation plan dictated by government would create an "artificial barrier."

Needy held that if an increase in demand for resources resulted in excess profits for a few companies, this simply meant the demand had increased. He did not anticipate problems of monopoly control under the auction plan.

"Monopoly power cannot exist unless a firm has the incentive to restrict its output, thereby forcing the price above the competitive level," he stated.

He maintained that in most cases this would not occur because an idle transponder would only result in the loss of profit by a corporation. But the report did not dismiss the possibility of satellite owners deciding to collude in setting prices.

Responding to the commission decision last week to consider a two-degree orbital spacing plan, Needy said the plan was "wasteful." The licensing scheme would enable satellites with frequencies in the four to six and 12 to 14 GHz bands to operate in two-degree orbital spacing. At present, satellites with four to six GHz operate in four-degree spacings; and those at 12 to 14 GHz at three degrees.

"Some firms may need four degrees for video and others one degree for a cruder signal," he said. The plan would give some firms twice as much as they needed and others half as much as they wanted." Needy said that from an economic standpoint, the sale of orbital spectrum would be the best way to achieve efficiency in allocating orbital slots.

Needy also urged the implementation of a flexible tariff. At present, firms providing satellite services are notified in advance of fixed tariff rates. Need said a flexible tariff would allow a firm to determine the free-market price that was raised or lowered by consumer demand.

Regarding the "first come first served" allocation plan, the report stated its drawbacks: "Giving the early birds all the worms," does not necessitate that the first applicants will provide society with the most highly valued services.

Needy suggested a second-best approach to orbital slot allocation where the commission could require minimal technical, financial and operational standards for applicants. In the event that the number of "best" applicants exceeded the number of available slots, the commission could then hold a lottery to determine the winners. Needy said this approach would minimize the arbitrary aspect of the "first come first served" plan without imposing the cost and delay required by a comparative hearing process. He added that the commission may still want to consider limiting the number of slots to any one carrier.

HBO Movies

Home Box Office has acquired a package of eight films from Columbia Pictures for 1982 showing on the pay service. No dollar figure was given on the purchase. The films are "Stripes," "Tess," "Nice Dreams," "Heavy Metal," "Modern Romance," "American Pop," "Nobody's Perfect" and "Happy Birthday To Me."

More On RCA's Auction

RCA Americom has made some changes in the procedure for its anticipated auction of transponders on Cable Net Two. First, the deadline for filing the "Auction Order Form" with the common carrier has been extended to October 27. Second, RCA has waived the requirement that any company wishing to participate in the auction must provide a certified check or irrevocable letter of credit for $100,000. Sometime shortly after October 27, RCA will announce the time and place of the auction. "Everything is, of course, contingent on the FCC not rejecting the tariff," said John Williamson, spokesman for RCA. The common carrier has filed two tariffs with the FCC—the auction method of allocation is one and the other is a first-come-first-served proposal. The FCC has not acted on either as yet. As for response to the proposed auction, Williamson said, "Interest has been considerable," but would not elaborate.

Pet Snagged

Program production problems is the reason TeleMine and Penthouse magazine give for a one-month delay in the launch of Penthouse Entertainment Network (PET), a joint adult pay venture between the two companies. Originally slated to debut October 15, the service has been pushed back to November.

"It's a question of how fast our original productions can be edited and completed," said Telemine programming director Judy Shepard. "We're also finishing up the look of the service. We have affiliates in hand and once our production situation is cleared up, we'll have all the details on who the affiliates are and how our schedule looks within a few weeks. We have no official November date yet, but that's the month we want to go."

Shepard declined to name any affiliates, but added that unlike such networks such as Private Screenings, Bravo and Escapade, which signed STV and MDS outlets as well as cable systems. However, PET would be "more than happy" to take on non-cable outlets, Shepard added.

PET is scheduled to launch over Westar I, transponder 3, with 12 hours of programming daily, seven days a week, from 8 p.m. to 8 a.m. Eastern time. According to promotional material, the service will blend up to 19 feature films per month with several original program series, including Gods and Goddesses (a celebrity interview series hosted by Lou Grant), The Body Shop (profiles on the Penthouse Pets), and After Hours, a late-night comedy showcase. Bo Derek and her husband, John, are waiting in the wings as the first guests on Gods and Goddesses, according to Shepard.

Because of the Westar I transponder, PET is pitching affiliates with earth station installation aimed at the service's temporary slot. The service plans to move to Westar V when that satellite is launched late next year.

FCC Reduce Satellite Spacing To 2 Degrees

In a move aimed at alleviating the scarcity of satellite orbital slots, the Federal Communications Commission has proposed to reduce spacing between individual satellites to two degrees to effectively double the present number of 4/6-GHz slots.

Currently, satellites operating in the 4/6-GHz frequency band are spaced four degrees apart, while spacecraft operating in the 12/14-GHz band must be separated by three degrees.

The commission, in proposing the modified spacing requirement, noted the increasing demand for domestic satellite communications services and battles between carriers for the limited orbital slots capable of covering the U.S.

Despite the technical ecomomic costs that may be created by reduced spacing, such as equipment modifications and loss of some operational flexibility. The FCC pointed out that its approval last year of the construction of 25 new satellites and the launch of 20 others dictated some regulatory action to resolve the orbital slot problem.

In addition to the new and planned spacecraft approved by the FCC, eight satellites currently are operating in the 4/6-GHz band, while two are providing service in the 12/14-GHz band.

Carriers with planned or existing systems include RCA American Communications, Western Union, AT&T, Comsat General, Southern Pacific Communications, Satellite Business Systems, Hughes Communications, and GTE Satellite Corp.

Premature Limitation

Ron Lepkowski, chief of the FCC's satellite radio branch, warned the commission that without reducing its orbital spacing requirement, the FCC could "prematurely limit the growth of the industry below what will be technologically or economically feasible."

He added that unless reduced spacing was implemented, the FCC would be forced to order orbital-slot shifts for satellites already in service, and reverse the long-standing "open skies" multiple-entry policy for the domestic satellite services market.

Conceding that the FCC was now uncertain how much reduced spacing would affect existing earth station facilities, Mr. Lepkowski asserted that two-degree spacing was "theoretically achievable," and if planned in advance, the costs of equipment modification should be relatively low.

Those modifications would focus on improved antenna performance for 4/6-GHz facilities, cross-polarization isolation, standardization of transponder plans, and frequency coordination for 12/14-GHz equip.

The commission voted to seek industry comments on the reduced spacing proposal, possible hardware modification costs, the impact of two-degree spacing on the ability of other Western Hemisphere nations to position their spacecraft between U.S. satellites, and the possibility of varied satellite spacing.

The FCC said specific comment dates would be set later.

SBS

The FCC approved the construction of a fourth satellite by Satellite Business Systems (SBS), to be used as a ground spare.

SBS, is exercising a contract option from its current vendor, Hughes Aircraft, for the construction of a fourth satellite valued at more than $20 million, told the FCC when its applied for authorization that traffic forecasts showed the need for a third in-operation SBS satellite.

The company predicted that by 1983, traffic demand would warrant more fully operational satellites, and added that it would request launch authority at that time for its third unit.

Procurement of a fourth satellite to be used as a spare would provide insurance against possible failure of its now operational satellite, according to the carrier.

SBS launched its second satellite in late September after solid-fuel motor problems delayed the launch originally slated for Sept. 2. The launch was successful.

Launched aboard a Delta 3910 vehicle and headed for 97 degree W. longitude orbital slot, SBS-2 is expected to begin providing service early next year.

More On The FCC And DBS

The potential major market for satellite, television and private earth station equipment moved one step closer to reality last week as the FCC formally accepted for consideration seven more direct broadcast satellite (DBS) service applications.

The companies that received approval were CBS, Direct Broadcast Satellite Corporation, RCA Americom, U.S. Satellite Broadcasting, Video Satellite Systems and Western Union. Focus Broadcasting, which submitted two applications, had one accepted and one denied. The first application proposed the use of the Westar system for its DBS service and was approved; the second application, which asked for permission to construct and operate its own satellite system, was denied for lack of sufficient technical information.

The lack of information was the main reason cited for rejecting the applications of five companies: Advance, Home Broadcast TV Partners, National Christian Network, Satellite Development Trust and Unitel Corporation. Several commissioners complained that the five companies had submitted information in hasty efforts to beat the July filing deadline. Commissioner Abbott Washburn said that consideration of the five applicants "would be unfair to the seven that filed complete applications and were serious."

Satellite Television Corp., a subsidiary of Comsat, initiated the rush of BBS applications last year when it requested FCC authorization to build and operate a $683.5 million satellite to home subscription TV service based on home decoders and rooftop antennas.

The commission accepted that application for consideration last April as part of the FCC's policy proposal to allow DBS operations in the 12-GHz frequency spectrum.

Although no final policies can be established until 1983 Regional Administrative Radio Conference allocates satellite frequencies and orbital slots to North and South American nations, the commission decided to sketch out interim DBS policies and accept interim applications in order to encourage investment in the satellite to home service.

According to the FCC's decisions thus far, early applicants who demonstrated a willingness to commit funding and build satellites quickly would be insulated from competing applications and lengthy comparative hearings after the North and South American slots and frequencies are set.

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